CHAPTER 10

NUTRIENT INTAKE

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CHAPTER 10

NUTRIENT INTAKE

10.0 INTRODUCTION

In this study, estimated intake of nutrients was of interest for the following reasons:

1) To describe the food culture of the populations surveyed, in nutrient terms.
2) To determine changes to nutrient intake upon migration.
3) To assess dietary adequacy and nutritional status.
4) To examine the inter-relationships between nutrients, health and lifestyle (chapter 12).

There have been several attempts to identify the nutrient composition of the Greek diet. However, most of these attempts have not relied on actual intake but on indirect measures, such as food balance sheets. Trichopoulou et al (1993a) have recently described the macronutrient composition of the Greek diet from case control studies; the diets of elderly Greeks have also been defined in the Euronut-Seneca study (de Groot et al., 1991). More data is clearly needed on the composition of the Greek diet and how it changes on migration.

Many population studies from different parts of the world have shown that free-living elderly people have relatively good food habits and nutrient intake (Horwath, 1989; Horwath et al., 1992; Steen, 1977; Rasanen et al., 1992; Lowik et al., 1989) and that the ageing process per se is not a cause of malnutrition in healthy elderly (Vellas et al., 1992; Lundgren et al., 1987; Sjogren et al., 1993). These studies have found a low to moderate prevalence of frank nutrient deficiencies, but a marked increase in *risk* of malnutrition and evidence of *subclinical* nutrient deficiencies. The significance of these observations becomes clear with the recognition that nutritional status influences the age-related rate of functional decline in many organ systems.

The objectives of this chapter include:

1. The nutrient composition of the elderly Greek diet by age group and gender
2. Changes to nutrient intake on migration
3. Nutrient adequacy of elderly Greek diets

Data on Spata Greeks was compared to:

a) Euronut-Seneca study (de Groot et al., 1991) - nutrient intake of rural Greeks aged 75 from Markopoulo, near Spata (M 33, F 27) and Anogia/Archanes, Crete (M 31, F 45); quantitative diet history for the previous month.

b) Case-control studies from Greece - nutrient intake of 838 (M 228, F 610) urban hospital patients aged 40-79 years (Trichopoulou et al., 1993a;Skalkidis et al., 1989; Katsouyanni et al., 1991; Manousos et al., 1985; Papadimitriou et al., 1984; Trichopoulou et al., 1992; Katsouyanni et al., 1988; Kalandidi et al, 1990).

Data on elderly Greek Australians was not available for comparison. Data was therefore compared to:

a) Department of Community Services, National Dietary Survey of Adults, 1983 - nutrient intakes of Southern European Australians aged 25-65 (M 203, F 172); 24 hour recall.

b) Wahlqvist et al., in press (IUNS) - nutrient intakes of Anglo-Celtic elderly Australians aged 70-79 from Melbourne (M 50, F 49); quantitative food frequency questionnaire.

c) Horwath, 1987 - Anglo-Celtic elderly Australians aged >70 yrs from Adelaide (M 901 men, F 1072); semiquantitative food frequency questionnaire.

Where data was not available for some nutrients, other international studies were compared. It is important to note the different dietary methods used in these studies, because differences in nutrient intakes can often exist as a result of the method chosen. For example, 24 hour recall is known to markedly underestimate habitual nutrient intake when compared to food frequency methods which assess long term intake (see also chapter 9). Furthermore, many of these studies were done prior to 1988 and thus changes in food and nutrient intakes may have occurred since then. Since the current study was carried out between 1988-1991, there are limitations in comparing with studies done earlier.

10.1 ENERGY INTAKE

With age, there is a gradual decline in food intake that corresponds to the smaller energy expenditure. During the early decades of adult life, total energy balance is positive, whereas in the late years, especially among the institutionalized elderly, energy and protein deficiency becomes more common, as food intake falls short of expenditure. As many as 30% and up to 60% or more of institutionalized elderly people display signs of energy deficiency. In contrast, only 3% of healthy free-living elderly persons have such signs (Rudman and Feller, 1989; Glick, 1992).

The United States has issued RDIs for energy according to age and physical activity (US National Research Council, 1989; Wahlqvist, 1990):

American RDIs for energy intake

Light Activity		
Age 51-75	M 70kg	10 100 Kj (2400 kcal)
	F 55kg	76 000 Kj (1800 kcal)
Sedentary Activity		
Age 76+	M 70kg	8600 Kj (2050 Kcal)
	F 55kg	6700 Kj (1600 Kcal)

In Australia, RDI's for energy for the older age group are as follows (activity level is not specified) (National Health and Medical Research Council NH&MRC, 1991):

Australian RDIs for energy intake

Men 64+ years 70kg	7400 - 11000 Kj (1760-2600kcal)
Women 54+ years 58kg	6500-9300 Kj (1550-2200kcal)

The coefficient of variation in energy needs for light to moderate activity approximates ±20% (US National Research Council, 1989).

Results: Average energy intake in Spata was 2200 kcal/day (9.2Mj/day) for the men and 1700kcal/day (7.1Mj/day) for the women. In Melbourne, energy intake was 2350kcal/day (9.9Mj) for the men and 1850kcal/day (7.8Mj/day) for the women. The men consumed significantly more calories than the women in both centres. Age group differences were not seen. Centre differences were not significant (see table 10.1). In Spata, 55% of the women and 69% of men had energy intakes above the recommended intakes for sedentary lifestyle. In Melbourne, significantly more women had energy intakes above the recommended (79%) compared with Spata women. About 73% of Melbourne men had intakes above recommended. Significantly more Spata elderly (mainly women) consumed less than 1200 kcal per day (M 4%, F 15%) compared with Melbourne elderly (M 0%, F 2%).

Comparisons with reported data: Very low energy intakes appear to be more prevalent in women. Intakes below approximately 5MJ (1200kcal) were reported in 12-18% of women in three random surveys (DHSS, 1972; MacLeod et al., 1974a; Kohrs et al., 1978) and at least one third of women in two non-random surveys (Yearick et al., 1980; Exton-Smith et al., 1972), none of which used the 24 hour recall method. Most studies estimated the percentage of subjects consuming less than the recommended energy intake to be about 50%. Below an intake of 5MJ it becomes increasingly difficult to achieve an adequate nutrient intake.

Table 10.1

Energy intake Kcal/day (Mj/Day)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	2268.0 (9.4)[a]	2114.0 (8.7)[b]	2405.0 (10.0)[c]	2302.0 (9.5)[d]
SD	460.0 (1.9)	380.0 (1.5)	547.0 (2.2)	501.0 (2.0)
Minimum	1049.0 (4.3)	906.0 (3.7)	1563.0 (6.5)	1437.0 (6.0)
5%	1506.0 (6.2)	906.0 (3.7)	1678.0 (6.9)	1460.0 (6.0)
25%	2046.0 (8.5)	1919.0 (7.9)	2053.0 (8.5)	1941.0 (8.0)
50%	2202.0 (9.1)	2237.0 (9.2)	2334.0 (9.7)	2230.0 (9.2)
75%	2571.0 (10.8)	2378.0 (9.8)	2665.0 (11.0)	2716.0 (11.2)
95%	3243.0 (13.5)	2519.0 (10.8)	3083.0 (12.8)	2946.0 (12.2)
Maximum	3246.0 (13.3)	2519.0 (10.8)	4764.0 (19.8)	3351.0 (13.9)
WOMEN				
N	31	22	59	36
Mean	1714.0 (7.1)[a]	1697.0 (7.0)[b]	1883.0 (7.8)[c]	1830.0 (7.6)[d]
SD	427.0 (1.7)	518.0 (2.1)	408.0 (1.6)	404.0 (1.6)
Minimum	967.0 (4.0)	1018.0 (4.2)	1154.0 (4.7)	1145.0 (4.7)
5%	1040.0 (4.3)	1139.0 (4.7)	1293.0 (5.3)	1230.0 (5.1)
25%	1292.0 (5.3)	1376.0 (5.6)	1513.0 (6.2)	1436.0 (5.9)
50%	1746.0 (7.2)	1548.0 (6.4)	1864.0 (7.7)	1857.0 (7.7)
75%	2148.0 (8.9)	1958.0 (8.1)	2167.0 (9.0)	2132.0 (8.8)
95%	2348.0 (9.7)	2806.0 (11.6)	2575.0 (10.7)	2452.0 (10.1)
Maximum	2453.0 (10.0)	2841.0 (11.7)	2896.0 (12.0)	2722.0 (11.3)

Same pair of letters show significant differences, Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
Gender differences: Spata 70-79 and 80+; Melbourne 70-79 and 80+
Age group differences: nil. *Centre differences:* nil.

In the Euronut-Seneca study, the mean energy intake of Markopoulo men and women was 2452±880 kcal and 2095±660 kcal respectively. Cretan men had higher mean intakes (2738±740kcal) and women lower (1738±480kcal) than Markopoulo elderly. The energy intake of Spata elderly aged 70-79 was similar to Greek subjects in the Euronut-Study (M 2268±460kcal, F 1714±427kcal). In the National Dietary survey of adults aged 25-65, mean energy intake of Southern European men (2300± SEM 88 kcal) and women (1700±SEM 88) was similar to Melbourne elderly Greeks aged 70-79 (M 2405±547kcal, F 1883±408kcal). Anglo-Celtic Australians aged 70+ in Melbourne also had similar mean energy intakes (M 2400±660 kcal, F 2070±580 kcal) to Melbourne Greeks. In contrast, Anglo-Celtic elderly Australians in Adelaide aged 70+ had significantly lower mean energy intakes (M 2000kcal, F 1700 kcal). This could be related to the dietary method used where portion sizes were not estimated.

Mean energy intakes were estimated to be above recommended levels for both sexes in several studies using true random population samples (Steen et al., 1977; Flint et al., 1981; Baghurst and Record 1983, 1987) and random convenience samples (Reid and Miles, 1977; Fidanza and Losito, 1981; Elsborg et al., 1983; Stuckey et al., 1984). In several other studies, mean intakes were above the recommended level for women only (Horwath, 1987) or for men only (DHSS, 1972; Fidanza and Alberti, 1974; MacLeod et al., 1974a,b,1975; Lonergan et al., 1975; Vir and Love, 1979; Betts and Vivian, 1984). Longitudinal studies (Stanton and Exton-Smith, 1970; Elahi et al., 1983) have shown energy intake to decrease with age.

10.2 MACRONUTRIENT INTAKE

The recommended dietary intakes (RDIs) enable only assessment of the adequacy of micronutrient intake (vitamins and minerals). However, overconsumption of fat, cholesterol, protein and energy and under-consumption of carbohydrate and fibre, are of far greater relevance with respect to diet-related morbidity and mortality (Horwath, 1989a). Standards to assess dietary adequacy in terms of such problems of malnutrition are the recommendations of the US Senate Select Committee on Nutrition and Human Needs, the British National Advisory Committee on Nutrition Education and the Australian Better Health Commission (Commonwealth Department of Health, 1987) for the contributions of the macronutrients to total energy.

The macronutrients available in the Australian food composition tables (NUTTAB 1991) included the following: total carbohydrate, complex and simple carbohydrate, protein, total fat, (saturated, monounsaturated, polyunsaturated), cholesterol, fibre and water.

The macronutrient intake of the study populations are presented as follows:

a) absolute intake (g/day)
b) nutrient density (g/Mj)
c) as a percentage of total energy intake.

Nutrient intake tends to increase with a higher energy intake (Thomas, 1988). Therefore, significant differences in nutrient intakes may exist when comparing study subjects simply due to differences in energy intake. By expressing nutrients per unit energy (i.e nutrient density) this effectively controls for total energy intake (shown in brackets next to absolute value in tables). Statistics were performed on the nutrient density values.

Nutrient density for each macronutrient (g/Mj) was calculated as follows:
(nutrient quantity/total kjoule intake) X 1000

The percentage energy intake from macronutrients was calculated as follows:
Carbohydrate: grams intake X 4kcal (17Kj)/ total Kcal intake
Protein: grams intake X 4kcal (17Kj)/ total Kcal intake
Fat: grams intake X 9kcal (38Kj)/ total Kcal intake
Alcohol: grams intake X 7kcal (29Kj)/ total Kcal intake

10.2.1 CARBOHYDRATE

Most national bodies recommend a total of 50-60% of total energy to be derived from carbohydrate - 40-50% energy as complex carbohydrate and only 15% from simple sugars or refined carbohydrates.

i. Total carbohydrate

Results: In both Spata and Melbourne, total carbohydrate intake was about 210g/day (22g/Mj) in the men and 170g/day (23g/Mj) in the women. Gender differences were not significant within centres. Age group differences were not seen in Spata, but in Melbourne the women aged 80+ had a higher carbohydrate density than the younger women. Centre differences were significant for the men and women aged 70-79 - Spata elderly had a higher carbohydrate density than Melbourne elderly (see table 10.2.1a). Percentage energy from carbohydrate was 39% in Spata and 37% in Melbourne. The majority of the subjects (90%) did not achieve the recommended energy intake from carbohydrates (see table 10.2.1b).

Comparisons with reported data: In the Euronut-Seneca study, percentage energy intake from carbohydrate was 42±6.4% for Greek men and 44±7% for Greek women, which was higher than values for Spata elderly (M 39±8%, F 39±7%). Absolute intakes of carbohydrate was also greater in Euronut elderly Greeks (M 270±86g/day, F 210±75g/day) compared with Spata elderly (M 210±65 g/day, F 170±57g/day). Case control studies from Greece have shown mean energy intakes from carbohydrate to fall between 35%-43%, with mean values for men aged 70+ (38%) being similar to women (36%) (Trichopoulou et al., 1993a).

Table 10.2.1a

Total carbohydrate intake g/day (g/Mj)

	SPATA		**MELBOURNE**	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	221.7 (23.4[i])	199.7 (22.5)	215.2 (21.5[i])	213.1 (22.2)
SD	66.4 (4.6)	64.3 (5.1)	60.3 (3.8)	54.0 (3.0)
Minimum	69.2 (10.5)	75.6 (12.0)	117.9 (12.9)	104.1 (14.3)
5%	120.2 (14.7)	75.6 (12.0)	139.1 (15.0)	145.0 (17.3)
25%	183.8 (20.1)	151.2 (20.0)	172.5 (18.8)	169.8 (20.5)
50%	216.3 (23.2)	208.7 (22.9)	209.0 (21.8)	210.4 (22.5)
75%	257.4 (26.8)	262.6 (26.1)	241.9 (24.2)	266.5 (24.5)
95%	354.1 (30.1)	295.1 (29.9)	314.9 (27.0)	302.9 (26.9)
Maximum	363.3 (32.4)	295.1 (29.9)	458.7 (32.6)	304.0 (27.6)
WOMEN				
N	31	22	59	36
Mean	167.9 (23.6[k])	170.5 (23.9)	168.6 (21.3[hk])	175.2 (23.1[h])
SD	49.4 (3.7)	65.4 (4.6)	50.4 (3.4)	44.7 (3.6)
Minimum	80.9 (16.7)	77.2 (15.7)	88.7 (13.4)	103.6 (17.3)
5%	92.9 (17.8)	78.6 (16.3)	100.4 (16.4)	110.2 (17.7)
25%	124.5 (21.2)	127.0 (20.9)	127.1 (18.7)	138.2 (20.9)
50%	161.0 (23.3)	156.4 (23.6)	162.2 (21.3)	170.4 (22.1)
75%	215.5 (25.8)	215.6 (28.2)	207.2 (23.7)	211.8 (24.7)
95%	255.0 (30.8)	292.5 (30.6)	259.9 (26.7)	260.9 (30.8)
Maximum	266.2 (32.4)	309.2 (32.4)	284.6 (30.7)	286.8 (35.7)

Same pair of letters show significant differences,Wilcoxon $p<0.05$:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
Gender differences: nil.
Age group differences: Spata nil; Melbourne women.
Centre differences: men 70-79; women 70-79.

Italians appear to have higher carbohydrate intakes (>40% energy intake) (Fidanza and Alberti, 1974; Fidanza and Losito, 1981; Fidanza 1988; Ferro-Luzzi and Sette, 1989) than Greeks. In the National Dietary survey of adults aged 25-65, percentage energy intakes from carbohydrates in Southern European men (41.7%±1, 250±10g/day) and women (40%±1, 175±10g/day - ±SEM) were slightly higher than values for Melbourne Greeks (M 37%±6, 214±57g/day; F 38%±6, 172±47g/day). Anglo-Celtic Australians aged 70-79 in Melbourne (IUNS) had significantly greater carbohydrate intakes (M 44%±8, 260±90g/day; F 44%±8, 230±82g/day) than Melbourne Greeks as did Anglo-Celtic elderly Australians in Adelaide aged 70+ (M 44%, 230g/day; F 45%, 200g/day). The majority of studies on elderly Anglo-Celtics indicate that total carbohydrates provide 42-47% of the energy intake (Baghurst and Record, 1983; Morgan and Zabik, 1984; Horwath, 1987; Victorian Nutrition Survey, 1987).

Table 10.2.1b

Percentage energy intake from total carbohydrate

	SPATA		**MELBOURNE**	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	38.8[i]	37.3	35.8[i]	37.0
SD	7.7	8.5	6.3	5.0
Minimum	17.4	19.9	21.4	23.9
5%	24.4	19.9	25.0	28.9
25%	33.4	33.3	31.2	34.2
50%	38.6	38.1	36.3	37.4
75%	44.4	43.3	40.3	40.8
95%	49.9	49.6	45.1	44.7
Maximum	53.6	49.6	54.5	45.9
WOMEN				
N	31	22	59	36
Mean	39.2[k]	39.6	35.5[hk]	38.4[h]
SD	6.2	7.6	5.7	6.0
Minimum	27.9	26.0	22.3	28.7
5%	29.7	27.0	27.3	29.4
25%	35.2	34.6	31.0	34.8
50%	38.7	39.3	35.4	36.7
75%	42.7	46.8	39.4	41.1
95%	51.1	50.8	44.4	51.2
Maximum	53.9	53.9	51.1	59.6

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
Gender differences: nil.
Age group differences: Spata nil; Melbourne women.
Centre differences: men 70-79; women 70-79.

ii. Complex Carbohydrates

Results: Complex carbohydrate intake for Spata men was 150g/day (16g/Mj) and 115g/day (16g/Mj) for the women. In Melbourne, mean intake was 127g/day (13g/Mj) for the men and 106g/day (13.8g/Mj) for the women. Percentage energy intake from complex carbohydrate was 27% in Spata and 23% in Melbourne, for both men and women. The majority of subjects (90%) did not achieve the recommended energy intake from complex carbohydrates. Gender and age group differences were not significant within centres. Centre differences were significant for the men and women aged 70-79- Spata elderly had a higher complex carbohydrate density than Melbourne elderly (see table 10.2.1c,d).

Table 10.2.1c

Complex carbohydrate intake g/day (g/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	161.8 (17.0[i])	134.3 (14.8)	130.8 (13.1[i])	124.9 (12.9)
SD	60.5 (4.9)	59.1 (5.3)	40.1 (2.8)	41.6 (2.9)
Minimum	46.4 (6.5)	20.6 (5.4)	75.0 (8.2)	52.9 (8.7)
5%	58.3 (7.0)	20.6 (5.4)	77.7 (8.7)	61.5 (8.8)
25%	125.7 (14.1)	90.3 (10.3)	103.8 (11.0)	100.7 (10.6)
50%	167.3 (16.4)	132.2 (14.5)	125.8 (12.6)	115.6 (13.2)
75%	197.8 (20.8)	196.9 (20.0)	152.3 (15.3)	161.3 (14.7)
95%	244.6 (25.5)	240.2 (25.1)	197.8 (19.0)	190.5 (18.4)
Maximum	330.0 (29.4)	240.2 (25.1)	266.9 (19.3)	220.0 (18.4)
WOMEN				
N	31	22	59	36
Mean	115.9 (16.1[k])	114.7 (15.7)	105.5 (13.4[k])	107.0 (14.2)
SD	44.9 (4.1)	58.4 (4.3)	32.3 (2.9)	27.6 (2.8)
Minimum	40.9 (5.6)	45.5 (7.9)	55.5 (8.1)	48.3 (8.0)
5%	46.4 (10.0)	54.5 (10.3)	57.4 (8.6)	70.3 (9.4)
25%	85.7 (12.9)	73.3 (12.6)	82.2 (11.4)	82.9 (12.6)
50%	109.4 (15.8)	87.4 (15.1)	104.1 (13.5)	104.6 (14.3)
75%	149.2 (19.4)	169.3 (18.5)	125.9 (14.6)	129.3 (15.7)
95%	191.7 (22.5)	230.5 (23.0)	163.8 (18.0)	147.1 (17.7)
Maximum	205.0 (22.8)	239.1 (23.0)	199.6 (23.6)	174.8 (23.7)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil. *Age group differences:* nil. *Centre differences:* men 70-79; women 70-79.

Comparisons with reported data: In the Euronut-Seneca study, elderly Greeks aged 75 had a greater intake of complex carbohydrate (mainly women) (M 170±65g/day, 28% of energy; F 140±60g/day, 27% of energy) compared with Spata elderly aged 70-79 (M 162±60g/day, 28%; F 116±45g/day, 27%). In the National Dietary survey of adults aged 25-65, mean intake of complex carbohydrates in Southern European men (151±8g/day ±SEM) and women (93±6g/day ±SEM) were similar to values for elderly Melbourne Greeks (M 130±40g/day, F 106±30g/day).

Table 10.2.1d

Percentage energy intake from complex carbohydrate

	SPATA		**MELBOURNE**	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	28.2[i]	24.6	21.8[i]	21.5
SD	8.2	8.8	4.8	4.8
Minimum	10.9	9.1	13.7	14.5
5%	11.7	9.1	14.5	14.7
25%	23.5	17.2	18.5	17.7
50%	27.2	24.0	21.0	21.9
75%	34.5	33.2	25.7	24.5
95%	42.4	41.6	31.6	30.6
Maximum	48.7	41.6	32.0	30.6
WOMEN				
N	31	22	59	36
Mean	26.8[k]	26.1	22.4[k]	23.6
SD	6.8	7.2	4.8	4.7
Minimum	9.4	13.2	13.6	13.4
5%	16.7	17.3	14.4	15.7
25%	21.5	20.9	16.4	20.9
50%	26.4	25.2	22.6	23.8
75%	32.2	30.8	24.4	26.2
95%	37.3	38.3	29.9	29.5
Maximum	37.7	38.3	39.3	39.4

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
Gender differences: nil. *Age group differences:* nil.
Centre differences: men 70-79; women 70-79.

Anglo-Celtic Australians aged 70+ in Melbourne also had a similar intake (M 135±60g/day, F 116±49g/day, 22% energy intake) to Melbourne Greeks. In contrast, Anglo-Celtic elderly Australians in Adelaide aged 70+ had significantly lower complex carbohydrate intakes (M 104g/day, F 88g/day). The majority of Anglo-Celtic elderly studies conducted in the mid 1980s indicate that complex carbohydrates provided 18-20% of the energy intake (Baghurst and Record, 1983; Morgan and Zabik, 1984;

Horwath, 1987; Victorian Nutrition Survey, 1987). In the 1990s, intake appears to have increased to the higher levels found in Southern Europeans. However, when compared to Greeks in Greece, migrant Greeks appear to have decreased their intake to the lower levels found in Anglo-Celtic Australians.

iii. Simple Carbohydrates

Results: Simple carbohydrate intake in Spata averaged 58g/day (7g/Mj) and 75g/day (8g/Mj) in Melbourne. Percentage energy intake was 12% in Spata and 14% in Melbourne. About 30-50% of Melbourne elderly were consuming more than 15% of their energy intake from refined carbohydrates compared with less than 10% of Spata elderly.

Table 10.2.1e

Simple carbohydrate intake g/day (g/Mj)

	SPATA		**MELBOURNE**	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	59.4 (6.3[i])	64.6 (7.5[j])	83.0 (8.3[i])	87.0 (9.2[j])
SD	22.7 (1.8)	26.5 (3.2)	34.2 (2.9)	29.0 (2.8)
Minimum	22.3 (2.9)	28.0 (3.6)	33.4 (3.3)	36.0 (3.4)
5%	31.2 (3.0)	28.0 (3.6)	39.2 (4.0)	44.2 (5.4
25%	44.1 (4.8)	49.9 (5.1)	56.0 (6.3)	69.3 (7.6)
50%	56.2 (6.6)	54.9 (6.4)	74.3 (7.9)	82.1 (8.6)
75%	70.4 (7.6)	73.7 (8.1)	105.0 (9.9)	107.0 (10.3)
95%	109.7 (8.6)	36.5 (14.0)	154.0 (13.6)	138.6 (13.8)
Maximum	128.8 (9.5)	36.5 (14.0)	190.0 (16.5)	150.6 (16.5)
WOMEN				
N	31	22	59	36
Mean	51.5 (7.4)	55.2 (8.1)	62.0 (7.8)	67.0 (8.7)
SD	17.7 (2.6)	27.3 (4.0)	30.0 (2.8)	30.8 (3.2)
Minimum	18.9 (3.7)	19.0 (2.9)	14.5 (2.3)	25.0 (4.4)
5%	21.5 (3.7)	23.8 (3.9)	27.8 (4.3)	30.0 (4.8)
25%	39.2 (5.8)	32.3 (0.0)	40.7 (6.1)	45.4 (6.6)
50%	50.3 (6.5)	55.7 (5.4)	54.3 (7.0)	62.6 (8.1)
75%	64.3 (8.3)	63.1 (7.0)	77.2 (9.2)	79.2 (9.4)
95%	79.6 (12.6)	95.1 (9.8)	127.4 (13.1)	123.0 (17.6)
Maximum	89.3 (15.6)	139.8 (11.8)	160.0 (17.6)	178.6 (18.6)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil. *Age group differences:* nil.
Centre differences: men 70-79 and 80+.

Gender and age group differences were not significant within centres. Centre differences were significant for the men aged 70-79 and 80+ - simple carbohydrate density was greater in Melbourne men than Spata men (see table 10.2.1f).

Table 10.2.1f

Percentage energy intake from simple carbohydrate

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	10.5[i]	12.6[j]	13.8[i]	15.3[j]
SD	3.1	5.4	4.8	4.7
Minimum	4.9	5.9	5.5	5.6
5%	5.0	5.9	6.7	8.9
25%	8.0	8.6	10.5	12.6
50%	11.1	10.7	13.2	14.4
75%	12.7	13.5	16.5	17.2
95%	14.3	23.3	22.7	23.0
Maximum	15.9	23.3	27.6	27.5
WOMEN				
N	31	22	59	36
Mean	12.3	13.5	12.9	14.5
SD	4.5	6.7	4.7	5.5
Minimum	6.2	4.9	3.8	7.4
5%	6.3	6.5	7.2	8.1
25%	9.6	9.0	10.2	11.0
50%	10.8	11.7	11.8	13.6
75%	13.9	16.4	15.2	15.7
95%	20.9	25.3	21.9	29.4
Maximum	26.0	33.0	29.3	31.1

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
Gender differences: nil. *Age group differences:* nil. *Centre differences:* men 70-79 and 80+.

Comparisons with reported data: In the Euronut study, elderly Greek men had a greater intake of simple carbohydrates (M 90±35g/day) than Spata men (62±25g/day). The Greek women (67±30g/day) had similar intakes to Spata women (53±22g/day). In the National Dietary survey of adults aged 25-65, mean intake of simple carbohydrates in Southern European men (101±6g/day ±SEM) and women (82±7g/day ±SEM) were significantly greater than values for elderly Melbourne Greeks (M 85±31g/day, F 64±30g/day), suggesting decreased consumption with age. Anglo-Celtic Australians aged 70+ in Melbourne had significantly greater intakes of sugars (M 123.7±55g/day, F 115±46g/day) compared with Melbourne Greeks, as did Anglo-Celtic elderly Australians in Adelaide aged 70+ (M 125g/day, F 113g/day). The majority of elderly studies indicate that simple carbohydrates provide 23-25% of the energy intake in Anglo-Celtic elderly

(Baghurst and Record, 1983; Morgan and Zabik, 1984; Horwath, 1987; Victorian Nutrition Survey, 1987). Even though total carbohydrate intake of elderly Greeks is lower than Anglo-Celtic Australians, elderly Greeks appear to be consuming significantly less carbohydrates as sugars (12-14% of total energy intake) and more as starches.

10.2.2 PROTEIN

From the literature it can be concluded that elderly subjects may need more dietary protein per kilogram of body weight to maintain their nitrogen balance than younger people. The protein proportion of total energy intake should not be less than 12-14%, and a daily protein intake of 1g/kg body weight should be regarded as sufficient to cover needs in both health and disease (Munro, 1983; Steen, 1992; Young, 1990; Kritchevsky, 1992). A high protein intake may be detrimental in that it may increase calcium excretion and may influence age-related loss of kidney function (Kritchevsky, 1992). However, other experiments have shown that the increased calcium excretion may only be transient, and one long-term study did not show any correlation between protein intake, ageing, and kidney function (Spencer et al., 1978; Tobin, 1986).

Results: Total protein intake averaged 80g/day (9.4g/Mj) in Spata and 100g/day (11g/Mj) in Melbourne. Percentage energy intake was 16% in Spata and 19% in Melbourne. Gender and age group differences were not significant within centres. Centre differences were significant - Melbourne elderly had a higher protein density than Spata elderly. A greater proportion of Spata women (6%) and men (8%) had protein intakes below 12% of energy intake compared with Melbourne elderly (M 1%, F 1%) (see table 10.2.2a,b).

Comparisons with reported data: In the Euronut-Seneca study, Greek elderly in Markopoulo had similar mean protein intakes (M 88±34g/day, F 78±24g/day) to Spata elderly (M 88.6±22g/day, F 67±22g/day) aged 70-79. Percentage energy from protein was also similar (Markopoulo M 14.5% F 15.2%; Spata M 15.6%, F 15.5%). Case control studies from Greece have shown mean energy intakes from protein to fall between 17%-20%, with mean values for men (19.1%) being similar to women (19.3%). The mean values for the elderly subjects aged 70+ were 19.4% for men and 19.6% for women (Trichopoulou et al., 1993a).

Table 10.2.2a

Protein intake g/day (g/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	88.6 (9.4^{i})	81.4 (9.3^{j})	114.1 (11.4^{i})	108.0 (11.3^{j})
SD	21.6 (1.4)	24.2 (2.2)	28.5 (1.6)	28.7 (1.9)
Minimum	35.8 (6.6)	39.5 (6.8)	62.1 (6.9)	67.2 (8.5)
5%	55.2 (6.7)	39.5 (6.8)	73.8 (9.1)	69.8 (8.8)
25%	74.9 (8.5)	68.9 (7.8)	93.0 (10.3)	85.7 (9.7)
50%	89.0 (9.4)	82.6 (8.7)	113.5 (11.3)	103.1 (11.2)
75%	100.5 (10.1)	86.6 (9.8)	132.8 (12.6)	126.5 (12.4)
95%	129.3 (12.2)	156.1 (16.0)	157.6 (14.5)	165.8 (15.2)
Maximum	136.9 (12.5)	156.1 (16.0)	202.6 (16.2)	174.3 (15.3)
WOMEN				
N	31	22	59	36
Mean	67.3 (9.3^{k})	67.7 (9.6^{l})	88.0 (11.3^{k})	81.5 (10.7^{l})
SD	21.7 (1.5)	24.9 (1.8)	23.7 (2.2)	23.2 (1.8)
Minimum	27.1 (5.7)	38.5 (7.4)	40.9 (7.3)	35.5 (6.1)
5%	31.8 (6.6)	42.3 (7.4)	56.4 (8.3)	39.2 (8.2)
25%	50.2 (8.8)	49.6 (8.2)	73.0 (9.9)	68.4 (9.3)
50%	68.0 (9.3)	61.6 (9.1)	81.4 (10.7)	78.3 (10.6)
75%	82.6 (9.9)	75.5 (10.8)	97.9 (12.1)	93.0 (11.8)
95%	104.4 (13.0)	105.7 (13.1)	137.8 (16.7)	132.7 (14.3)
Maximum	108.7 (13.0)	144.0 (13.5)	171.2 (18.2)	147.1 (14.7)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil. *Age group differences:* nil.
Centre differences: men 70-79 and 80+; women 70-79 and 80+.

In the National Dietary survey of adults aged 25-65, mean intake of protein in Southern European men (98±4g/day ±SEM) and women (80±4g/day ±SEM) were similar to elderly Melbourne Greeks (M 110±28g/day, F 85±23g/day). Percentage energy from protein was similarly high in Southern Europeans (M 17.5%, F 20.4%) as seen in elderly Greeks in Melbourne (M 19%, F 18%). Anglo-Celtic Australians aged 70+ in Melbourne (IUNS) also had similar mean intakes and percentage energy from protein (M 103±32g/day, 17.5%; F 98±38g/day, 19%), to Melbourne Greeks. In contrast, Anglo-Celtic elderly Australians in Adelaide aged 70+ had slightly lower intakes of protein (M 78g/day, 16.3%; F 71g/day, 17.3%) than Melbourne Greeks. Random and non-random studies, have found protein intake in the elderly as well as body protein stores (serum protein and serum albumin) to be more than satisfactory (NHANES Leichter et al, 1978; Kohrs et al., 1978; Borgstrom et al., 1979; Flint et al., 1981; Burr et al., 1982). Less than one third of subjects in studies have been found to have intakes below the recommended level of protein intake, and that at least 12-16% of energy intake was derived from protein.

Table 10.2.2b

Percentage energy intake from protein

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	15.6[i]	15.4[j]	19.0[i]	18.8[j]
SD	2.3	3.7	2.7	3.1
Minimum	10.9	11.3	11.5	14.1
5%	11.1	11.3	15.1	14.7
25%	14.1	13.0	17.1	16.1
50%	15.6	14.4	18.9	18.8
75%	16.9	16.3	21.0	20.6
95%	20.2	26.7	24.2	25.4
Maximum	20.9	26.7	26.9	25.6
WOMEN				
N	31	22	59	36
Mean	15.5[k]	15.9[l]	18.8[k]	17.8[l]
SD	2.6	3.0	3.7	3.1
Minimum	9.4	12.3	12.2	10.2
5%	11.0	12.3	13.8	13.7
25%	14.6	13.6	16.5	15.4
50%	15.5	15.1	17.8	17.6
75%	16.5	17.9	20.1	19.7
95%	21.6	21.9	27.8	23.8
Maximum	21.7	22.5	30.3	24.4

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
Gender differences: nil.
Age group differences: nil.
Centre differences: men 70-79 and 80+; women 70-79 and 80+.

10.2.3 FAT

It is recommended to reduce total fat intake to 30% or less calories. There is evidence that further reduction in fat intake may confer even greater health benefits. However, epidemiological evidence indicates that Mediterranean countries with a high intake of total fat (>40%) but derived mainly from monounsaturated fat have low rates of heart disease (US National Research Council, 1989; Wahlqvist and Kouris-Blazos, 1991a). In the past, it was recommended by most national bodies to consume *10%* of energy as *saturated fat* (palmitic, myristic, lauric stearic acids), *10%* as *polyunsaturated fat* (linoleic, linolenic, EPA eicosapentanoic, DHA docosahexanoic acids) and *10%* from *monounsaturated fat* (oleic acid).

Emerging evidence points to the adverse effects of high intakes of polyunsaturated fats (namely *linoleic acid*) and *saturated fats*, and the benefits of a high *monounsaturated fat* intake found mainly in olive oil, rape seed oil and almonds (Wahlqvist and Kouris-Blazos, 1991a). It has been suggested that excess *polyunsaturated linoleic acid,* may pose special problems, particularly in the elderly. It has been associated with impaired immune function, inflammation, generation of atherogenic oxidised cholesterol, coronary heart disease, sudden cardiac arrest and possible tumour formation (Nestel 1992, Abraham et al., 1990).

Based on these observations and assumptions, many researchers have indicated that there is a strong case for reducing linoleic acid and saturated fat intake even further and increasing linolenic acid, EPA, DHA and monounsaturated fats. Suggestions for revised recommendations include the following (Nestel, 1992; Wahlqvist and Kouris-Blazos, 1991a; Horrobin and Manku, 1983; US National Research Council, 1989):
Total fat 30% of energy intake (current intake in Australia 35%-40%)
<7% saturated fat (current intake in Australia 15%)
<7% (preferably 2-4%) linoleic acid (current intake in Australia 6-7%)
>15% as oleic acid (current intake in Australia 11%).

i. Total fat

Results: Total fat intake averaged 90g/day (11.5g/Mj) in Spata and 99g/day (11.5g/Mj) in Melbourne. Percentage energy intake was 42% in Spata and Melbourne. Gender and age group differences were not significant in Spata. In Melbourne, the women aged 70-79 consumed significantly more fat than the men. Centre differences were not significant. Less than 5% of subjects had fat intakes below 30% of energy intake (see tables 10.2.3a,b).

Table 10.2.3a

Total fat intake g/day (g/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	101.1 (10.8)	95.4 (11.0)	112.2 (11.1[c])	105.5 (11.1)
SD	22.9 (1.8)	20.3 (2.0)	30.9 (1.4)	26.7 (1.4)
Minimum	44.6 (6.8)	49.6 (7.1)	60.9 (7.7)	55.9 (7.7)
5%	66.7 (8.4)	49.6 (7.1)	69.5 (8.6)	65.4 (8.6)
25%	81.1 (9.5)	79.5 (9.4)	92.2 (10.5)	87.1 (10.5)
50%	106.7 (10.4)	98.6 (10.8)	112.2 (11.2)	104.7 (11.2)
75%	117.0 (12.0)	111.8 (13.0)	124.5 (11.9)	119.3 (11.9)
95%	140.0 (13.2)	126.4 (14.3)	156.6 (14.0)	146.5 (14.0)
Maximum	148.8 (17.0)	126.4 (14.3)	237.0 (15.3)	171.6 (15.3)
WOMEN				
N	31	22	59	36
Mean	83.7 (11.8)	78.7 (11.3)	92.3 (11.8[c])	86.4 (11.2)
SD	22.3 (1.5)	23.6 (1.9)	22.1 (1.5)	23.9 (1.5)
Minimum	46.8 (8.5)	40.4 (8.3)	54.2 (8.0)	38.0 (6.3)
5%	47.4 (8.7)	48.7 (8.5)	55.5 (8.8)	41.4 (7.2)
25%	64.1 (10.9)	62.8 (9.7)	75.0 (10.8)	66.2 (10.6)
50%	84.4 (11.9)	74.4 (11.2)	96.8 (11.8)	90.9 (11.3)
75%	101.1 (12.9)	92.9 (12.5)	110.1 (12.6)	101.9 (12.3)
95%	121.6 (13.9)	114.9 (14.8)	126.3 (14.2)	124.0 (13.8)
Maximum	122.5 (15.2)	137.6 (15.4)	132.8 (15.5)	127.9 (14.2)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: Spata nil; Melbourne 70-79.
Age group differences: nil.
Centre differences: nil.

Comparisons with reported data: In the Euronut-Seneca study, Greek elderly in Markopoulo had slightly higher (not significant) mean fat intakes (M 113±42g/day, F 101±26g/day) than Spata elderly (M 101±23g/day, F 84±22g/day). Percentage energy from fat was also similar to Spata elderly aged 70-79 (Markopoulo M 42±6%, F 45±6%; Spata M 40±7%, F 44±6%). In case control studies from Greece, mean energy intakes from fat were between 40%-50%, with mean values for men (42%) being significantly lower than women (46%). The elderly subjects aged 70+ in these studies tended to have the highest fat intakes (M 43%, M 46%) (Trichopoulou et al., 1993a).

Table 10.2.3b

Percentage energy intake from fat

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	40.4	41.1	41.8[c]	41.2
SD	6.9	7.7	5.4	4.5
Minimum	25.4	26.6	29.0	32.8
5%	31.5	26.6	32.1	34.1
25%	35.5	35.2	39.4	38.6
50%	39.1	40.3	42.1	41.4
75%	45.1	48.7	44.5	43.1
95%	49.4	53.4	52.4	49.9
Maximum	63.4	53.4	57.5	51.1
WOMEN				
N	31	22	59	36
Mean	44.1	42.3	44.1[c]	42.1
SD	5.7	7.2	5.5	5.8
Minimum	31.8	31.3	30.2	23.7
5%	32.5	31.9	33.2	27.0
25%	40.5	36.4	40.4	39.9
50%	44.5	41.8	44.2	42.2
75%	48.2	46.9	47.2	46.0
95%	52.0	55.5	53.2	51.8
Maximum	56.6	57.6	58.0	53.2

Same pair of letters show significant differences,Wilcoxon $p<0.05$:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
Gender differences: Spata nil; Melbourne 70-79.
Age group differences: nil.
Centre differences: nil.

In the National Dietary survey of adults aged 25-65, mean intakes of fat in Southern European men (90±5g/day ±SEM) and women (72±4g/day ±SEM) were lower than elderly Melbourne Greeks (M 108±29g/day, F 89±23g/day). Similarly, percentage energy intake from fat was significantly lower in Southern Europeans (M 33%, F 37%) than elderly Greeks in Melbourne (M 41.5%, F 43%). The lower fat intake obtained in the National Dietary Survey is related to the dietary method used to assess oil intakes (Webb and Manderson 1990).

Anglo-Celtic Australians aged 70+ in Melbourne (IUNS) had significantly lower mean intakes and percentage energy from fat (M 90±31g/day, 34%; F 80±26g/day, 35%), compared with Melbourne Greeks. Similarly, Anglo-Celtic elderly Australians in Adelaide aged 70+ (Horwath, 1997) had lower intakes of fat (M 86g/day, 38%; F 73g/day, 37%) than Melbourne Greeks. Studies from the UK, USA, Australia and Northern Europe have found the percentage of energy derived from fat to be around 35%-40% (Pekkarinen et al., 1974; Lonergan et al., 1975; McClean et al., 1976; Steen et al., 1977; Greger and Sciscoe, 1977; Grotkowski and Sims, 1978; Leichter et al., 1978; Borgstrom et al., 1979; Yearick et al., 1980; Garry et al., 1982a, b; Morgan and Zabik, 1984; Stuckey et al., 1984; McGandy et al., 1986; Baghurst and Record, 1983, 1987; Victorian Nutrition Survey, 1987). Studies from Italy indicate lower fat intakes (<35% energy intake) (Fidanza and Alberti, 1974; Fidanza and Losito, 1981; Fidanza 1988; Ferro-Luzzi and Sette, 1989) compared with the Greek studies. Thus in most studies, the percentage of energy derived from dietary fat was above the levels recommended by most national bodies (30%).

ii. Saturated fat

Results: Saturated fat intake averaged 26g/day (3.2g/Mj) in Spata and 29g/day (3.3g/Mj) in Melbourne. Percentage energy intake was 12% in Spata and Melbourne. Gender differences were significant within centres for the 70-79 age group - men consumed more saturated fat than the women. However, a greater proportion of men had saturated fat intakes below the recommended (Spata 27%, Melbourne 20%) compared with the women (Spata 11%, Melbourne 8%). Age group and centre differences were not significant (see tables 10.2.3c,d).

Comparisons with reported data: In the Euronut-Seneca study, Greek elderly had similar mean saturated fat intakes (M 30±13g/day, F 22±8g/day) compared to Spata elderly aged 70-79 (M 28±8g/day, F 24±8g/day). Percentage energy from saturated fat was also similar to Spata elderly (Euronut M 10.2%, F 10.5%; Spata M 11.5%, F 12.5%). These results on rural Greeks are significantly lower than values from case control studies on 838 urban Greeks aged 40-79 (M 17%, F 20%) (Trichopoulou et al., 1993a). Anglo-Celtic Australians aged 70+ in Melbourne (IUNS) had significantly higher mean intakes and percentage energy from saturated fat (M 37±16g/day, 15%; F 33±13g/day, 15%), compared with Melbourne Greeks (M 32±10g/day, 12.5%; F 25±7g/day, 12.5%).

Table 10.2.3c

Saturated fat intake g/day (g/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	28.2 (3.0[a])	28.1 (3.3)	32.1 (3.2[c])	32.7 (3.4)
SD	8.1 (0.6)	6.3 (0.7)	10.7 (0.6)	9.4 (0.5)
Minimum	12.4 (1.9)	16.9 (2.1)	14.2 (1.8)	15.5 (2.3)
5%	18.2 (2.1)	16.9 (2.1)	19.5 (2.3)	16.6 (2.5)
25%	22.4 (2.6)	23.1 (2.6)	24.7 (2.7)	25.6 (2.9)
50%	26.4 (2.9)	28.9 (3.1)	30.0 (3.0)	32.8 (3.4)
75%	31.8 (3.3)	32.7 (3.8)	37.0 (3.8)	39.9 (3.8)
95%	46.8 (4.0)	41.9 (4.5)	49.0 (4.3)	47.5 (4.1)
Maximum	54.0 (4.6)	41.9 (4.5)	73.7 (4.5)	52.2 (4.6)
WOMEN				
N	31	22	59	36
Mean	24.1 (3.4[a])	23.5 (3.3)	26.7 (3.4[c])	24.7 (3.2)
SD	7.7 (0.8)	9.4 (0.6)	7.4 (0.6)	6.2 (0.5)
Minimum	11.4 (2.2)	11.0 (2.2)	13.5 (1.9)	12.2 (2.0)
5%	13.2 (2.3)	13.7 (2.3)	15.8 (2.4)	13.3 (2.3)
25%	16.5 (2.8)	18.3 (2.9)	20.4 (2.9)	20.7 (2.9)
50%	24.0 (3.3)	21.7 (3.4)	26.8 (3.3)	23.8 (3.2)
75%	29.5 (3.7)	27.9 (3.6)	32.4 (3.7)	29.7 (3.6)
95%	35.0 (4.7)	34.3 (4.5)	40.6 (4.8)	35.9 (3.8)
Maximum	45.8 (6.3)	55.9 (4.8)	44.1 (5.2)	38.6 (4.7)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: Spata 70-79; Melbourne 70-79.
Age group differences: nil.
Centre differences: nil.

Anglo-Celtic elderly Australians in Adelaide aged 70+ (Horwath, 1997) also had higher intakes of saturated fat (M 36g/day, 15.5%; F 30g/day 15%) compared with Melbourne Greeks. Other studies in Australia, US and UK have shown saturated fatty acids to account for 14%-18% of the total energy intake (Borgstrom et al., 1979; Fanelli and Brush, 1984; Baghurst and Record, 1983, 1987; Victorian Nutrition Survey, 1987). Overall, saturated fat intakes from all studies are well above the recommended 10% of energy intake.

Table 10.2.3d

Percentage energy intake from saturated fat

	SPATA		**MELBOURNE**	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	11.0[a]	12.0	12.0[c]	13.0
SD	2.0	3.0	2.0	2.0
Minimum	7.0	8.0	7.0	9.0
5%	8.0	8.0	8.0	10.0
25%	10.0	10.0	10.0	11.0
50%	11.0	12.0	11.0	13.0
75%	12.0	14.0	14.0	14.0
95%	15.0	17.0	16.0	15.0
Maximum	17.0	17.0	17.0	17.0
WOMEN				
N	31	22	59	36
Mean	13.0[a]	12.0	13.0[c]	12.0
SD	3.0	2.0	2.0	2.0
Minimum	8.0	8.0	7.0	8.0
5%	8.0	9.0	9.0	9.0
25%	11.0	11.0	11.0	11.0
50%	12.0	13.0	13.0	12.0
75%	14.0	13.0	14.0	13.0
95%	17.0	17.0	18.0	14.0
Maximum	24.0	18.0	20.0	18.0

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
Gender differences: Spata 70-79; Melbourne 70-79.
Age group differences: nil.
Centre differences: nil.

iii. Monounsaturated fat

Results: Monounsaturated fat intake averaged 46g/day (6.0g/Mj) in Spata and 48g/day (5.4g/Mj) in Melbourne. Percentage energy intake was 22% in Spata and 21% in Melbourne. Gender and age group differences were not significant within centres. Centre differences were seen only in the women aged 70-79; Spata women obtained a greater proportion of their total energy intake from monounsaturated fats than Melbourne women (see tables 10.2.3e,f).

Table 10.2.3e

Monounsaturated fat intake g/day (g/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	52.8 (5.7)	49.2 (5.7)	55.4 (5.5)	50.0 (5.2)
SD	13.4 (1.3)	11.8 (1.2)	15.6 (0.9)	13.1 (0.8)
Minimum	23.6 (3.2)	25.0 (3.5)	28.8 (3.5)	26.7 (3.8)
5%	30.9 (3.8)	25.0 (3.5)	33.0 (3.8)	29.4 (4.0)
25%	42.4 (4.7)	40.9 (4.7)	44.1 (5.0)	40.2 (4.5)
50%	53.9 (5.7)	52.8 (5.7)	54.9 (5.5)	49.0 (5.0)
75%	62.9 (6.4)	58.9 (6.6)	63.7 (6.0)	58.3 (5.6)
95%	73.0 (7.6)	63.3 (7.5)	83.4 (7.4)	72.7 (6.9)
Maximum	83.0 (9.5)	63.3 (7.5)	118.2 (8.1)	74.1 (7.2)
WOMEN				
N	31	22	59	36
Mean	43.6 (6.2[k])	40.5 (5.9)	44.5 (5.6[k])	42.6 (5.5)
SD	12.6 (1.1)	11.6 (1.4)	12.4 (1.0)	14.4 (1.1)
Minimum	20.7 (3.9)	21.3 (3.6)	23.1 (3.6)	15.1 (2.6)
5%	24.5 (4.3)	23.1 (4.1)	25.0 (3.9)	17.2 (2.8)
25%	32.6 (5.2)	30.3 (4.8)	34.9 (4.8)	28.9 (4.9)
50%	42.6 (6.5)	40.3 (5.7)	44.7 (5.7)	45.2 (5.5)
75%	53.2 (6.8)	49.7 (6.7)	55.2 (6.3)	54.0 (6.4)
95%	64.5 (7.9)	58.0 (8.7)	66.6 (7.4)	64.4 (7.3)
Maximum	67.2 (8.9)	59.1 (8.9)	69.8 (7.9)	69.7 (7.7)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil. *Age group differences:* nil. *Centre differences:* women 70-79.

Comparisons with reported data: In the Euronut-Seneca study, Greek elderly had similar mean monounsaturated fat intakes (M 54±19g/day, F 42±13g/day) compared to Spata elderly aged 70-79 (M 53±13g/day, F 44±13g/day). Percentage energy intake from monounsaturated fat was also similar to Spata elderly (Euronut M 19%, F 21%; Spata M 21%, F 22%). These results on rural Greeks are slightly higher than values from case control studies on 838 urban Greeks aged 40-79 (M 16.3%, F 18.4%) (Trichopoulou et al., 1993a).

Anglo-Celtic Australians aged 70-79 in Melbourne had significantly lower mean intakes and percentage energy from monounsaturated fat (M 30±10g/day, 11%; F 26±10g/day, 11%), compared with Melbourne Greeks aged 70-79 (M 55±16g/day, 21%; F 44±6g/day, 21%). Anglo-Celtic elderly Australians in Adelaide aged 70+ (Horwath, 1997) also had lower intakes of monounsaturated fat (M 28g/day, 13%; F 24g/day 13%) than Melbourne Greeks.

Table 10.2.3f

Percentage energy intake from monounsaturated fat

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	21.0	21.0	21.0	20.0
SD	5.0	5.0	4.0	3.0
Minimum	12.0	13.0	13.0	15.0
5%	14.0	13.0	15.0	15.0
25%	18.0	17.0	19.0	17.0
50%	21.0	21.0	21.0	19.0
75%	24.0	25.0	23.0	21.0
95%	28.0	28.0	28.0	26.0
Maximum	36.0	28.0	30.0	27.0
WOMEN				
N	31	22	59	36
Mean	23.0[k]	22.0	21.0[k]	21.0
SD	4.0	5.0	4.0	4.0
Minimum	14.0	13.0	14.0	10.0
5%	16.0	15.0	15.0	11.0
25%	20.0	18.0	18.0	18.0
50%	24.0	21.0	21.0	21.0
75%	25.0	25.0	24.0	24.0
95%	30.0	33.0	28.0	27.0
Maximum	33.0	33.0	30.0	29.0

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
Gender differences: nil.
Age group differences: nil.
Centre differences: women 70-79.

iv. Polyunsaturated fat

Results: Polyunsaturated fat intake averaged 10g/day (1.3g/Mj) in Spata and 15g/day (1.6g/Mj) in Melbourne. Percentage energy intake was 5% in Spata and 6% in Melbourne. Gender and age group differences were not significant in Spata. In Melbourne, the women aged 70-79 consumed more polyunsaturated fat than the men. Centre differences were significant for men and women in both age groups; Melbourne elderly obtained a greater proportion of their total energy intake from polyunsaturated fats than Spata elderly (see tables 10.2.3g,h).

Table 10.2.3g

Polyunsaturated fat intake g/day (g/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	12.0 (1.3^{i})	10.7 (1.2^{j})	16.3 (1.6^{ci})	14.7 (1.5^{j})
SD	2.7 (0.2)	2.3 (0.2)	6.5 (0.4)	7.0 (0.5)
Minimum	5.1 (0.9)	4.1 (0.9)	7.2 (0.9)	7.3 (0.9)
5%	8.4 (1.0)	4.1 (0.9)	9.2 (1.0)	7.8 (0.9)
25%	10.6 (1.1)	9.8 (1.1)	11.9 (1.2)	10.2 (1.1)
50%	11.8 (1.2)	11.2 (1.2)	15.1 (1.5)	14.3 (1.3)
75%	13.3 (1.4)	12.2 (1.3)	19.8 (1.8)	17.0 (1.7)
95%	17.0 (1.8)	13.7 (1.5)	30.2 (2.3)	23.0 (2.7)
Maximum	18.6 (1.9)	13.7 (1.5)	43.4 (3.4)	43.8 (3.1)
WOMEN				
N	31	22	59	36
Mean	9.7 (1.4^{k})	8.7 (1.2^{l})	14.2 (1.8^{ck})	12.4 (1.6^{l})
SD	2.9 (0.3)	2.9 (0.2)	4.9 (0.5)	4.5 (0.4)
Minimum	4.4 (0.9)	4.3 (0.6)	5.3 (0.8)	4.5 (0.7)
5%	5.1 (1.0)	4.4 (0.9)	6.6 (1.0)	5.9 (1.1)
25%	7.4 (1.2)	7.5 (1.1)	11.2 (1.4)	9.3 (1.2)
50%	9.6 (1.3)	7.9 (1.2)	13.6 (1.7)	12.0 (1.5)
75%	12.4 (1.4)	9.8 (1.3)	17.1 (2.2)	14.4 (1.9)
95%	14.8 (1.8)	13.6 (1.5)	24.1 (2.8)	23.7 (2.6)
Maximum	15.9 (2.5)	14.5 (1.6)	27.3 (3.5)	23.9 (2.8)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: Spata nil; Melbourne 70-79.
Age group differences: nil.
Centre differences: men 70-79 and 80+; women 70-79 and 80+.

Comparisons with reported data: In the Euronut study, Greek elderly had similar mean polyunsaturated fat intakes (M 10±4g/day, F 8.5±13g/day) compared to Spata elderly (M 11±2g/day, F 9±1g/day). Percentage energy from polyunsaturated fat was also similar to Spata elderly (Euronut M 5%, F 4%; Spata M 5%, F 5%). These results on rural Greeks are similar to values from case control studies on 838 urban Greeks aged 40-79 (M 4.5%, F 3.5%) (Trichopoulou et al., 1993).

Anglo-Celtic Australians aged 70-79 in Melbourne (IUNS) had similar mean intakes and percentage energy from polyunsaturated fat (M 15±6g/day, 6%; F 13±5g/day, 6%), compared to Melbourne Greeks (M 15.5±7g/day, 6%; F 13±5g/day, 6%) as did Anglo-Celtic elderly Australians in Adelaide (M 14g/day, 6%; F 12g/day 6%).

Table 10.2.3h

Percentage energy intake from polyunsaturated fat

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	5.0[i]	5.0[j]	6.0[ci]	6.0[j]
SD	1.0	1.0	2.0	2.0
Minimum	3.0	3.0	4.0	3.0
5%	4.0	3.0	4.0	3.0
25%	4.0	4.0	5.0	4.0
50%	5.0	4.0	6.0	5.0
75%	5.0	5.0	7.0	7.0
95%	7.0	5.0	9.0	10.0
Maximum	7.0	5.0	13.0	12.0
WOMEN				
N	31	22	59	36
Mean	5.0[k]	5.0[l]	7.0[ck]	6.0[l]
SD	1.0	1.0	2.0	2.0
Minimum	4.0	2.0	3.0	3.0
5%	4.0	3.0	4.0	4.0
25%	4.0	4.0	5.0	5.0
50%	5.0	5.0	6.0	6.0
75%	5.0	5.0	9.0	7.0
95%	7.0	6.0	11.0	10.0
Maximum	9.0	6.0	13.0	10.0

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
Gender differences: Spata nil; Melbourne 70-79.
Age group differences: nil.
Centre differences: men 70-79 and 80+; women 70-79 and 80+.

v. Ratio of unsaturated to saturated fats

The ultimate mix of fatty acids is described by the polyunsaturated + monounsaturated/saturated fat (P+M/S) ratio, which should be greater than 2, ideally about 3 (de Groot et al., 1991) (see table 10.2.3i).

Results: The P+M/S ratio was 2.2 in both Spata and Melbourne. Gender, age group and centre differences were not significant.

Table 10.2.3i

Polyunsaturated + monounsaturated fat/ saturated fat

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	2.3	2.1	2.3	2.0
SD	0.5	0.3	0.4	0.4
Minimum	1.1	1.5	1.5	1.3
5%	1.7	1.5	1.6	1.4
25%	2.0	1.8	1.9	1.6
50%	2.2	2.1	2.2	2.1
75%	2.6	2.4	2.5	2.3
95%	3.4	2.8	3.3	2.8
Maximum	3.7	2.8	3.9	2.9
WOMEN				
N	31	22	59	36
Mean	2.3	2.1	2.2	2.2
SD	0.6	0.4	0.4	0.4
Minimum	0.9	1.2	1.2	1.2
5%	1.1	1.2	1.4	1.6
25%	1.9	1.9	2.0	1.9
50%	2.2	2.2	2.2	2.1
75%	2.5	2.3	2.5	2.4
95%	3.7	2.8	3.0	2.8
Maximum	4.0	3.0	3.2	3.8

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
Gender differences: nil. *Age group differences:* nil. *Centre differences:* nil.

Comparisons with reported data: In the Euronut-Seneca study, Greek elderly had a similar P+M/S ratio (2.5) to Spata elderly (2.2). Anglo-Celtic Australians aged 70+ in Melbourne had significantly lower ratios (1.2) compared with Melbourne Greeks (2.2). Anglo-Celtic Australians in Adelaide aged 70+ (Horwath, 1997) also had lower ratios (1.3) than Melbourne Greeks. There is evidence from the Seven Countries Study (Hartog et al., 1968; Keys et al., 1971, 1980, 1986) that olive oil intake has decreased during the last 20 years in Greece (Corfu and Crete) (Aravanis and Ioannidis, 1984). This decrease in olive oil consumption is reflected in the fatty acid composition of the diets of 181 Cretan men aged 40-60 in 1988 (Kafatos et al., 1991). In 1960, percent total energy from fat was 40%, 8% saturated, 29% monounsaturated, 3% polyunsaturated with a P+M/S ratio of 4. In 1988, the percentage total energy intake from fat had decreased to 36%, saturated fats had increased to 10%, monounsaturates had decreased to 17%, polyunsaturates remained unchanged at 3% and the P+M/S ratio had markedly dropped to 1.96. These dietary changes parallel the observed increase in the total serum cholesterol from 4.7mmol/l to 6.4mmol/l (i.e a 36% increase) and higher rates of heart disease.

10.2.4 CHOLESTEROL

Most national bodies recommend that cholesterol intake not exceed 300mg/day (US National Research Council, 1989).

Results: Cholesterol intake averaged 240mg/day (30mg/Mj) in Spata and 320mg/day (37mg/Mj) in Melbourne. Gender and age group differences were not significant within centres. Centre differences were significant for men and women aged 70-79; Melbourne elderly had a higher cholesterol density than Spata elderly. Only 17% of the Spata women and 31% of the men had cholesterol intakes above 300mg/day. In contrast, 32% of Melbourne women and 70% of men had intakes above the recommended (table 10.2.4).

Comparisons with reported data: In the Euronut-Seneca study, Greek elderly had similar mean cholesterol intakes (M 244±110mg/day, F 175±72mg/day) to Spata elderly (M 272±106mg/day, F 199±110mg/day). In the National Dietary survey of adults aged 25-65, mean intake of cholesterol in Southern European men (358±22mg/day ±SEM) and women (288±20mg/day ±SEM) were similar to elderly Melbourne Greeks (M 360±147mg/day, F 283±98mg/day). Anglo-Celtic Australians aged 70+ in Melbourne had similar mean cholesterol intakes (M 343±147mg/day, F 333±105mg/day, to Melbourne Greeks.

Adelaide elderly (Horwath, 1997) also had similar mean intakes of dietary cholesterol (M 310mg/day, F 260mg/day) to Melbourne Greeks with only 31% of men and 16% of women having intakes above the recommended. Other random surveys in Australia conducted by Baghurst and Record (1987) and the Victorian Nutrition Survey (1987) have shown mean cholesterol intakes to be around 300mg (M 396, F 298 mg; M 247, F 225mg). Most other studies have reported mean cholesterol intakes significantly greater than the recommended level (Horwath, 1989a).

Table 10.2.4

Cholesterol intake mg/day (mg/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	271.9 (28.6[i])	285.9 (33.2)	361.4 (35.9[i])	357.4 (37.5)
SD	105.6 (8.2)	135.6 (15.3)	133.1 (10.2)	162.1 (13.8)
Minimum	69.6 (14.0)	108.6 (11.0)	156.8 (17.9)	175.5 (21.8)
5%	120.3 (15.3)	108.6 (11.0)	169.8 (22.5)	205.7 (22.2)
25%	205.8 (22.5)	171.1 (22.7)	273.0 (28.9)	261.5 (30.2)
50%	251.7 (29.5)	270.3 (31.9)	348.5 (34.7)	338.4 (35.1)
75%	308.5 (34.1)	359.6 (44.3)	432.6 (40.8)	391.5 (40.6)
95%	513.5 (41.3)	575.0 (71.6)	575.3 (51.8)	541.7 (56.9)
Maximum	520.8 (48.5)	575.0 (71.6)	878.5 (82.4)	1067.3 (94.1)
WOMEN				
N	31	22	59	36
Mean	199.2 (27.2[j])	221.2 (32.4)	283.8 (36.4[j])	281.8 (37.8)
SD	109.6 (12.2)	107.0 (15.7)	111.2 (11.7)	86.2 (12.1)
Minimum	53.1 (9.5)	86.5 (16.1)	79.9 (12.0)	120.7 (24.0)
5%	57.0 (12.9)	108.5 (16.4)	131.9 (19.2)	164.6 (25.4)
25%	119.7 (18.6)	143.7 (22.1)	211.0 (28.1)	229.1 (29.4)
50%	181.4 (24.8)	180.2 (26.4)	264.4 (34.2)	276.8 (31.8)
75%	257.6 (32.4)	253.4 (41.3)	337.4 (43.5)	328.5 (48.5)
95%	401.3 (44.4)	432.7 (66.9)	500.2 (59.5)	489.4 (59.6)
Maximum	529.8 (73.1)	480.7 (71.3)	688.0 (67.1)	510.0 (81.2)

Same pair of letters show significant differences, Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil. *Age group differences:* nil. *Centre differences:* men 70-79;women 70-79.

10.2.5 ALCOHOL

Most national bodies recommend that alcohol intake not exceed 5% of daily energy intake (2 standard drinks/day, <20g/day). Low-moderate alcohol intake (3-5% energy intake) has been associated with reduced rates of heart disease (US National Research Council, 1989). However, recommendations do not encourage abstainers to start consuming alcohol; habitual drinkers are advised to reduce intake to 1-2 standard drinks per day (US National Research Council, 1989).

Results: Alcohol intake averaged 10g/day (M 16g/day; F 3g/day) in Spata and 6g/day (M 10g/day, F 3g/day) in Melbourne. Percentage energy intake were similar in Spata (M 5%, F 1%) and Melbourne (M 3%, F 1%). Men consumed more alcohol than the women within centres, but age group differences were not observed. A greater proportion of

Spata women never consumed alcohol (83%) compared with Melbourne women (50%). Similar proportions of men never consumed alcohol (34%) (see tables 10.2.5a,b).

Comparisons with reported data: In the Euronut-Seneca study, Greek elderly had similar mean alcohol intakes (M 16.8±19g/day, F 2.4±8.7g/day) to Spata elderly (M 16±16g/day, F 2.7±6g/day). Percentage energy from alcohol was also similar (M 4.5%, F 0.5%) to Spata (M 5%, F 1%). In the Levkadian Migrant Health Study (Powles et al., 1991), siblings (and their families) aged 25-74 who had migrated from the Greek island of Levkada to Melbourne reported markedly lower alcohol consumption (n=846, M 16g/day, F 2g/day) when compared with their counterparts who stayed on the island (n=498, M 54g/day, F 16g/day). These results are significantly greater than mean intakes obtained on Spata elderly, suggesting that alcohol intake may decrease with age.

Table 10.2.5a

Alcohol intake g/day (g/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	15.0 (1.5[a])	17.3 (1.9[b])	10.7 (1.1[c])	9.5 (0.9[d])
SD	13.3 (1.4)	19.8 (2.1)	14.2 (1.4)	12.4 (1.2)
Minimum	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
5%	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
25%	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
50%	18.2 (1.7)	9.1 (1.0)	4.6 (0.56)	4.0 (0.3)
75%	25.6 (2.4)	37.3 (3.7)	17.2 (1.7)	16.7 (1.8)
95%	45.5 (5.1)	54.6 (5.7)	39.1 (4.1)	37.9 (3.6)
Maximum	45.6 (5.3)	54.6 (5.7)	64.9 (5.9)	38.7 (3.6)
WOMEN				
N	31	22	59	36
Mean	1.5 (0.2[a])	3.9 (0.5[b])	3.3 (0.4[c])	3.2 (0.5[d])
SD	4.1 (0.52)	9.1 (1.3)	7.8 (1.1)	4.7 (0.7)
Minimum	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
5%	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
25%	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
50%	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
75%	0.0 (0.0)	0.0 (0.0)	1.9 (0.3)	8.5 (1.0)
95%	9.2 (1.8)	18.2 (2.7)	18.2 (2.3)	14.0 (1.9)
Maximum	18.2 (2.1)	36.4 (5.7)	44.4 (7.0)	14.2 (2.4)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: Spata 70-79 and 80+; Melbourne 70-79 and 80+.
Age group differences: nil.
Centre differences: nil.

Table 10.2.5b

Percentage energy intake from alcohol

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	4.5[a]	5.5[b]	3.1[c]	2.8[d]
SD	4.1	6.2	4.1	3.6
Minimum	0.0	0.0	0.0	0.0
5%	0.0	0.0	0.0	0.0
25%	0.0	0.0	0.0	0.0
50%	4.9	3.0	1.6	0.9
75%	7.0	10.9	4.9	5.1
95%	14.9	16.6	11.9	10.5
Maximum	15.4	16.6	17.0	10.5
WOMEN				
N	31	22	59	36
Mean	0.5[a]	1.6[b]	1.2[c]	1.4[d]
SD	1.5	3.9	3.2	2.1
Minimum	0.0	0.0	0.0	0.0
5%	0.0	0.0	0.0	0.0
25%	0.0	0.0	0.0	0.0
50%	0.0	0.0	0.0	0.0
75%	0.0	0.0	0.9	3.1
95%	5.1	16.7	6.6	5.5
Maximum	6.1	16.7	20.3	7.0

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
Gender differences: Spata 70-79 and 80+; Melbourne 70-79 and 80+.
Age group differences: nil. *Centre differences:* nil.

In the Australian National Dietary survey of adults aged 25-65, mean alcohol intakes of Southern Europeans (M 24.6±3g/day ±SEM, F 7.1±1.7g/day ±SEM) were significantly greater than elderly Melbourne Greeks (M 10±13g/day, F 3.3±6g/day) as were percentage energy intakes (M 7.4%, F 2.3%). This suggests that alcohol intake decreases with age. Anglo-Celtic Australians aged 70-79 in Melbourne (IUNS) had similar mean intakes and percentage energy from alcohol (M 14±20g/day, 4.9%; F 3±6g/day, 2.8%), compared to Melbourne Greeks. Anglo-Celtic elderly Australians in Adelaide aged 70+ (Horwath, 1997) also had similar intakes of alcohol (M 8.5g/day, 3%; F 2.5g/day 1%) to Melbourne Greeks. In the 1972 DHSS survey, alcohol made a negligible contribution to energy intake for both sexes, but in the Italian study (Fidanza and Losito, 1981) it contributed 17% and 7% of the energy intakes of elderly men and women, respectively. In other studies, the average contribution varied from 1.5 to 6% for men and 0.3 to 2.3% for women. Alcohol consumption decreases with age and the frequency of heavy drinkers and prevalence of chronic alcoholism is much lower in the elderly than in the younger adult population (Goodwin et al., 1987; MacLeod et al., 1974a; Garry et al., 1982a; Horwath, 1987; Victorian Nutrition Survey, 1987).

10.2.6 FIBRE

Results: Most national bodies recommend that dietary fibre intakes be increased to 30g/day (US National Research Council, 1989). Fibre intake averaged 18g/day (2.3g/Mj) in Spata and 25g/day (2.8g/Mj) in Melbourne. Gender differences were not significant within centres. Age group differences were seen in Spata men only. Melbourne elderly had a greater fibre density than Spata elderly. Only 8% of Spata men and 0% of women had fibre intakes above 30g/day. In contrast, 21% of Melbourne women and 35% of men had intakes above recommended (see table 10.2.6).

Table 10.2.6

Fibre intake g/day (g/Mj)

	SPATA		**MELBOURNE**	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	22.7 (2.4[ei])	18.4 (2.1[ej])	29.8 (3.0[i])	25.7 (2.6[j])
SD	6.4 (0.4)	5.5 (0.4)	10.3 (0.8)	8.9 (0.7)
Minimum	11.2 (1.4)	7.7 (0.9)	10.6 (1.3)	11.5 (1.4)
5%	11.6 (1.6)	7.7 (0.9)	16.9 (2.0)	13.1 (1.5)
25%	19.2 (2.0)	15.2 (1.9)	22.6 (2.3)	20.0 (2.1)
50%	22.9 (2.3)	20.1 (2.1)	28.5 (2.8)	24.5 (2.4)
75%	25.2 (2.6)	22.2 (2.3)	34.9 (3.5)	34.1 (3.2)
95%	35.8 (3.4)	26.9 (3.0)	47.6 (4.2)	41.1 (4.0)
Maximum	39.2 (3.5)	26.9 (3.0)	64.8 (6.0)	43.3 (4.2)
WOMEN				
N	31	22	59	36
Mean	16.6 (2.3[k])	16.2 (2.3[l])	24.2 (3.0[k])	21.4 (2.8[l])
SD	5.6 (0.4)	5.7 (0.4)	8.2 (0.8)	7.0 (0.6)
Minimum	7.0 (1.4)	7.7 (1.4)	7.7 (1.2)	9.2 (1.6)
5%	7.0 (1.5)	10.0 (1.6)	10.1 (1.6)	11.7 (1.9)
25%	12.0 (1.9)	12.0 (2.1)	18.6 (2.6)	16.8 (2.3)
50%	16.6 (2.3)	15.3 (2.3)	23.8 (3.1)	21.4 (2.7)
75%	21.5 (2.6)	18.3 (2.5)	28.3 (3.5)	24.1 (3.3)
95%	25.9 (3.0)	27.4 (2.8)	37.5 (4.4)	35.9 (3.7)
Maximum	27.4 (3.0)	27.6 (3.2)	55.6 (5.6)	36.2 (4.0)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil. *Age group differences:* Spata men.
Centre differences: men 70-79 and 80+; women 70-79 and 80+.

Comparisons with reported data: In the Euronut-Seneca study, Greek elderly had similar mean fibre intakes (M 18±7g/day, F 14±5g/day) to Spata elderly aged 70-79 (M 23±6g/day, F 17±6g/day). In the National Dietary survey of adults aged 25-65, mean fibre intake of Southern European men (21±1.4g/day ±SEM) and women (18.2±1.4g/day ±SEM) were lower than elderly Melbourne Greeks (M 28±10g/day, F 22±3g/day).

Anglo-Celtic Australians aged 70-79 in Melbourne had similar mean fibre intakes (M 28±11g/day, F 30±16g/day) to Melbourne Greeks (M 30±10g/day, F 24±8g/day). Anglo-Celtic elderly Australians in Adelaide aged 70+ (Horwath, 1997) had lower intakes of fibre (M 20g/day, F 20g/day) to Melbourne Greeks, with only 13% of women and 11% of men having intakes above 30g/day. Dietary fibre intakes of about 20g per day have been reported for the general population both in Britain (Bingham et al., 1979) and Australia (Baghurst and Record, 1983). In other random surveys, mean fibre intakes of only 14-15g (Barasi et al., 1985; Johnson et al., 1980) and crude fibre intakes of 3-5g (Greger and Sciscoe, 1977; Morgan and Zabik, 1984; Ludman and Newman, 1986) have been reported.

10.2.7 WATER

In aged persons, fluid balance becomes an important factor in homeostasis and deserves serious consideration as part of nutritional assessment. Usual requirements are estimated at 1ml/kcal ingested or 30ml/kg of body weight (Chernoff and Lipschitz, 1988). In other words, about 2 litres (8-10 glasses) of fluid is required daily

In elderly individuals inadequate fluid intake may lead to problems associated with dehydration. Many elderly patients have symptoms of dehydration that are unrecognized or are attributed to other causes e.g elevated temperature, hypertension, constipation, confusion, nausea, vomiting. Owing to thirst and osmoregulatory mechanism disturbances, impaired capacity to conserve water, inability to concentrate urine efficiently due to an ageing kidney, excessive diuretic therapy, immobility, or infection will lead to intercompartmental fluid shifts and rapid dehydration (Chernoff and Lipschitz, 1988).

Results: Water intake reported here included drinking water, water in coffee and tea, water in foods (e.g fruit, yoghurt, casseroles) and other beverages (e.g fruit juice, soft drinks, milk). Water intake averaged 2280g/day in Spata and 2150g/day in Melbourne. Men had a higher water intake than the women within centres. Age group differences were not observed. Centre differences were seen in men only aged 70-79 - Spata men consumed more water than Melbourne men. About 50% of the elderly in Spata and Melbourne had water intakes above the recommended (F >1700g/day, M >2200ml/day); 76% of Spata men aged 70-79 had intakes above 2200ml/day. Very low water intakes (<1200ml) were found in women only (15%), possibly putting them at risk of dehydration (see table 10.2.7).

Table 10.2.7

Water intake g/day

	SPATA		**MELBOURNE**	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	3022.0[ai]	2559.9[b]	2397.0[ci]	2485.0[d]
SD	1138.0	767.1	704.0	674.0
Minimum	1345.1	772.8	1293.0	1511.0
5%	1582.1	772.8	1571.0	1545.0
25%	2071.6	2239.6	1898.0	1975.0
50%	2789.2	2364.4	2304.0	2463.0
75%	3948.8	3152.2	2743.0	2814.0
95%	5103.0	4015.9	3571.0	3513.0
Maximum	6241.4	4015.9	5588.0	4461.0
WOMEN				
N	31	22	59	36
Mean	1848.5[a]	1670.2[b]	1937.0[c]	1742.0[d]
SD	670.8	441.9	644.0	576.0
Minimum	895.7	923.7	823.0	1006.0
5%	935.6	990.8	939.0	1077.0
25%	1485.3	1232.4	1494.0	1307.0
50%	1722.3	1714.7	1884.0	1615.0
75%	2188.9	1946.4	2341.0	2132.0
95%	3245.7	2284.7	3243.0	2812.0
Maximum	3428.7	2618.9	3758.0	3682.0

Same pair of letters show significant differences,Wilcoxon $p<0.05$:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
Gender differences: Spata 70-79 and 80+; Melbourne 70-79 and 80+
Age group differences: nil.
Centre differences: men 70-79.

Comparisons with reported data: Few studies have reported water intake in elderly subjects. Elderly Anglo-Celtic Australian men in Melbourne had similar mean water intakes (2660±736g/day) to Greek men (Spata 2800g±950/day; Melbourne 2400±690g/day). In contrast, Anglo-Celtic women had significantly higher mean intakes (2561±875g/day) than the Greek women (Spata 1760±555g/day; Melbourne 1840±610g/day).

10.3 MICRONUTRIENT INTAKE

The published studies suggest that inadequate intakes of fruit and vegetables may be common; that calcium, zinc, potassium, magnesium, thiamin, riboflavin, vitamin B6, folate are likely to be the nutrients least adequately supplied in the diets of elderly people (Horwath, 1989a; de Groot et al., 1991). The significance of these observations becomes clear with the recognition that nutritional status influences the age-related rate of functional decline in many organ systems. As such dietary inadequacies may have important health implications for the elderly population, it is important to collect more data on the food and nutrient intake of representative groups of elderly people.

The micronutrients available in the food composition tables (NUTTAB 1991) used in this study included the following:

minerals - sodium, potassium, calcium, phosphorus, magnesium, iron, zinc,
vitamins - vitamin A, retinol, carotene, thiamin, riboflavin, niacin and vitamin C.
Vitamin B6, B12, vitamin E, selenium and folate were not available. However, B12 and folate status were assessed from blood samples (see section 10.3.13 and Chapter 11).

The micronutrient intake of the study populations are presented as follows:

a) absolute intake (g or mg or μg/day)
b) nutrient density (nutrient quantity/Mj)

Nutrient intake tends to increase with a higher energy intake (Thomas, 1988). Therefore, significant differences in nutrient intakes may exist when comparing study subjects simply due to differences in energy intake. By expressing nutrients per unit energy (i.e nutrient density) this effectively controls for total energy intake (shown in brackets next to absolute value in tables). Statistics were performed on the nutrient density values. The tables include micronutrient intake from the diet only; micronutrients obtained from supplements are not included.

Nutrient density for each micronutrient was calculated as follows:
(nutrient quantity/kjoule) X 1000.

10.3.1 SODIUM

A sodium intake of <2300mg is recommended by the Nutrition Taskforce of the Australian Better Health Commission (Commonwealth Department of Community Services and Health, 1987).

Results: Sodium intake averaged 1860mg/day (225mg/Mj) in Spata and 2000mg/day (228mg/Mj) in Melbourne - these values do not include salt added to food at the table. The range of sodium intakes were greater in Melbourne, especially for men (1000-6800mg) compared with Spata (1000-3800mg). Gender differences were not significant within centres for sodium density. However, men had significantly higher absolute values than the women. Age group differences were also seen in Melbourne women - sodium density was higher in women aged 70-79 than in the women 80+. Centre differences were not significant for nutrient densities. However, Melbourne women aged 70-79 had significantly higher absolute values than Spata women (see table 10.3.1).

Salt was added to food at the table by 30% of the elderly in the sample. Significantly less Spata elderly (55%) reported adding salt to food whilst cooking compared with 73% of the Melbourne elderly. Overall, there appears to be a greater use of discretionary salt by Melbourne Greeks. Discretionary salt could not be added to non-discretionary sources of sodium intake because: a) the food analysis programme did not have this facility (NUTTAB) b) standards for an average 'pinch' or 'shake' are based on Anglo-Celtic Australians. Nevertheless, it appears that Melbourne Greeks may have a higher sodium intake than Spata Greeks if discretionary salt is added.

Comparisons with reported data: In the elderly Anglo-Celtic Australian study in Melbourne, sodium intake (non-discretionary only) was significantly greater (M 3274±1096mg/day, F 2950±1127mg/day) than Melbourne Greeks (M 2240±840mg/day, F 1771±570mg/day). Other studies excluding discretionary salt showed average sodium intake levels in elderly populations to be in the range of 2200-2900 mg (96-126mmol) per day in men and 1600-2000 mg (70-87mmol) per day in women (Horwath, 1989a). Values from the elderly Greeks in this study appear to be at the lower end of this range. The inclusion of discretionary salt in the large Adelaide elderly study (Horwath, 1987) gave average intakes of 2847mg in men and 2523mg in women. In the Victorian Nutrition

Survey average intakes were higher (M 3200mg, F 2900mg). It appears that the sodium in the food supply itself (naturally occurring or added in commercial food production) already equals or exceeds the recommended range for dietary sodium. In the large Adelaide study, 73% of men and 60% of women had intakes above 2300mg (included discretionary salt). In the Greek study, 20% of women and 45% of men had intakes above 2300mg (non-discretionary only).

Table 10.3.1

Sodium intake mg/day (mg/Mj)
(non-discretionary only)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	2276.0 (239)	1989.0 (223)	2389.0 (237)	2089.0 (217)
SD	746.0 (49)	746.0 (67)	1018.0 (81)	655.0 (46)
Minimum	1001.0 (137)	610.0 (124)	904.0 (101)	1110.0 (134)
5%	1220.0 (152)	610.0 (124)	1224.0 (151)	1171.0 (136)
25%	1675.0 (208)	1508.0 (161)	1811.0 (195)	1397.0 (182)
50%	2231.0 (238)	1642.0 (212)	2241.0 (227)	2172.0 (221)
75%	2679.0 (274)	2774.0 (269)	2718.0 (261)	2757.0 (249)
95%	3816.0 (336)	3349.0 (385)	4101.0 (333)	2862.0 (280)
Maximum	3867.0 (345)	3349.0 (385)	6831.0 (740)	3139.0 (299)
WOMEN				
N	31	22	59	36
Mean	1610.0 (225)	1588.0 (215)	1911.0 (242[h])	1631.0 216[h])
SD	541.0 (48)	884.0 (69)	616.0 (50)	518.0 (61)
Minimum	568.0 (141)	564.0 (105)	865.0 (142)	839.0 (123)
5%	770.0 (146)	585.0 (123)	1056.0 (158)	873.0 (123)
25%	1237.0 (191)	939.0 (154)	1503.0 (203)	1278.0 (179)
50%	1601.0 (222)	1308.0 (217)	1812.0 (236)	1635.0 (208)
75%	1960.0 (259)	2074.0 (260)	2255.0 (285)	1958.0 (251)
95%	2716.0 (335)	3058.0 (334)	3311.0 (335)	2394.0 (343)
Maximum	2734.0 (357)	3703.0 (353)	3771.0 (351)	3082.0 (409)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil.
Age group differences: Melbourne women.
Centre differences: nil.

10.3.2 POTASSIUM

Results: Potassium intake averaged 2300mg/day (283mg/Mj) in Spata and 3100mg/day (357mg/Mj) in Melbourne. Gender and age group differences were not significant within centres for potassium density. However, men consumed significantly more absolute amounts of potassium compared with women. Melbourne elderly had higher potassium intakes and densities than Spata elderly (see table 10.3.2).

Table 10.3.2

Potassium intake mg/day (mg/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	2713.0 (288^{i})	2349.0 (267^{j})	3605.0 (361^{i})	3414.0 (358^{j})
SD	791.0 (57)	667.0 (57)	964.0 (63)	909.0 (68)
Minimum	1072.0 (154)	872.0 (179)	2047.0 (218)	1784.0 (224)
5%	1634.0 (214)	872.0 (179)	2136.0 (252)	1941.0 (278)
25%	2157.0 (246)	1990.0 (214)	2972.0 (319)	2714.0 (306)
50%	2469.0 (281)	2269.0 (261)	3568.0 (362)	3312.0 (351)
75%	3251.0 (331)	2626.0 (306)	4069.0 (394)	4059.0 (401)
95%	4092.0 (396)	3858.0 (397)	5203.0 (479)	4625.0 (505)
Maximum	4502.0 (414)	3858.0 (397)	6812.0 (494)	5773.0 (538)
WOMEN				
N	31	22	59	36
Mean	2103.0 (290^{k})	2025.0 (289^{l})	2837.0 (363^{k})	2653.0 (347^{l})
SD	732.0 (57)	692.0 (49)	732.0 (56)	781.0 (54)
Minimum	828.0 (168)	1157.0 (185)	1309.0 (246)	1478.0 (243)
5%	1003.0 (169)	1337.0 (203)	1732.0 (268)	1507.0 (263)
25%	1259.0 (248)	1508.0 (253)	2252.0 (321)	2018.0 (311)
50%	2286.0 (311)	1838.0 (293)	2738.0 (365)	2525.0 (347)
75%	2614.0 (335)	2141.0 (335)	3347.0 (401)	3140.0 (377)
95%	3007.0 (380)	3372.0 (353)	4044.0 (462)	4439.0 (453)
Maximum	3550.0 (394)	3913.0 (355)	5072.0 (489)	4577.0 (459)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil.
Age group differences: nil.
Centre differences: men 70-79 and 80+; women 70-79 and 80+.

Comparisons with reported data: Most studies have shown mean dietary potassium intakes ranging between 2200-3600mg in men and 1800-3400mg in women (Horwath, 1989a). The highest intakes have been reported in the South Australian study (Baghurst and Record, 1987). In the elderly Anglo-Celtic Australian study in Melbourne (IUNS), mean potassium intake of the men (3741±1087mg/day) was similar to Melbourne Greek men (3509±930mg/day). The Anglo-Celtic women had a significantly greater mean intake (3689±1084g/day) than Melbourne Greek women (2745±750mg/day). Anglo-Celtic elderly also had high potassium densities, (M 386mg/Mj, F 434mg/Mj). Elderly in the Adelaide study had similar mean potassium intakes (M 3334mg/day, 3300mg/day) to Melbourne Greeks. The greater potassium intakes reported in men than in women appear to be due simply to their greater energy intakes (Davies, 1981). However, when energy is controlled, these differences disappear.

10.3.3 CALCIUM

Results: Calcium intake averaged 630mg/day (80mg/Mj) in Spata and 750mg/day (85mg/Mj) in Melbourne. Gender, age group and centre differences were not significant for calcium density. However, men consumed significantly more absolute amounts of calcium compared with the women (see table 10.3.3).

Comparisons with reported data: In the Euronut-Seneca study, Greek elderly had significantly greater mean calcium intakes (M 1200±535mg/day, F 923±374mg/day) than Spata elderly (M 686±441mg/day, F 580±241mg/day). Mean calcium densities were also significantly greater (Euronut 111mg/Mj, Spata 80mg/Mj). However, a large proportion of the women (45%) had intakes below 500mg/day. In the National Dietary survey of adults aged 25-65, mean intake of calcium in Southern European men (724±40mg/day ±SEM) and women (769±108mg/day ±SEM) were similar to elderly Melbourne Greeks (M 840±370mg/day, F 652±215mg/day). Anglo-Celtic Australian men aged 70+ in Melbourne had similar mean calcium densities (855±394mg/day, 85.4±26mg/Mj) to elderly Greek men in Melbourne (840±370mg/day, 86±30mg/Mj). The Anglo-Celtic women had a significantly higher mean intake (905±405mg/day, 105±40mg/Mj) than Melbourne women (652±215mg/day, 84±21mg/Mj). Anglo-Celtic elderly Australians in Adelaide aged 70+ (Horwath, 1997) also had similar mean calcium values (M 940mg/day, F 852mg/day) to the Melbourne Anglo-Celtics.

Table 10.3.3

Calcium intake mg/day (mg/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	697.0 (73)	676.0 (79)	801.0 (80)	881.0 (92)
SD	265.0 (20)	176.0 (21)	311.0 (23)	429.0 (36)
Minimum	318.0 (48)	441.0 (52)	391.0 (37)	386.0 (41)
5%	357.0 (50)	441.0 (52)	445.0 (49)	402.0 (50)
25%	517.0 (55)	557.0 (61)	556.0 (61)	662.0 (70)
50%	666.0 (70)	674.0 (71)	770.0 (78)	852.0 (86)
75%	771.0 (84)	761.0 (96)	934.0 (93)	977.0 (108)
95%	1446.0 (117)	1185.0 (122)	1263.0 (110)	1313.0 (131)
Maximum	1580.0 (117)	1185.0 (122)	1949.0 (175)	2718.0 (237)
WOMEN				
N	31	22	59	36
Mean	580.0 (82)	579.0 (81)	668.0 (85)	637.0 (83)
SD	222.0 (27)	260.0 (23)	212.0 (21)	219.0 (21)
Minimum	241.0 (42)	197.0 (46)	270.0 (47)	289.0 (42)
5%	246.0 (43)	311.0 (49)	352.0 (58)	304.0 (52)
25%	375.0 (63)	450.0 (63)	529.0 (68)	496.0 (67)
50%	598.0 (78)	539.0 (77)	632.0 (82)	598.0 (81)
75%	744.0 (91)	670.0 (96)	789.0 (100)	754.0 (99)
95%	865.0 (148)	841.0 (122)	1109.0 (123)	1034.0 (130)
Maximum	1173.0 (162)	1464.0 (125)	1226.0 (141)	1333.0 (135)

Same pair of letters show significant differences,Wilcoxon $p<0.05$:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil. *Age group differences:* nil. *Centre differences:* nil.

10.3.4 PHOSPHORUS

Results: Phosphorus intake averaged 1040mg/day (130mg/Mj) in Spata and 1350mg/day (150mg/Mj) in Melbourne. Gender and age group differences were not significant within centres for phosphorus density. However, men had higher absolute intakes than the women. Centre differences were significant for men and women in both age groups - Melbourne elderly had a higher mean phosphorus intake and density than Spata elderly (see table 10.3.4).

Comparisons with reported data: Anglo-Celtic Australian men aged 70-79 in Melbourne had similar mean phosphorus densities (1589±512mg/day, 161±24mg/Mj) to Melbourne Greek men (1512±428mg/day, 154±26mg/Mj), but significantly higher values than Spata men (1142±286mg/day, 126±22mg/Mj). Anglo-Celtic women had a significantly higher mean phosphorus intake (1598±582mg/day, 185±37mg/Mj) than elderly Greek women in Melbourne (1185±353mg/day, 153±28mg/Mj) and Spata (940±323mg/day, 132±24mg/Mj). Anglo-Celtic elderly Australians in Adelaide aged 70+ (Horwath, 1997) also had similar mean phosphorus values (M 1350mg/day, F 1300mg/day) to the Melbourne Anglo-Celtics.

Table 10.3.4

Phosphorus intake mg/day (mg/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	1172.0 (124[i])	1113.0 (128[j])	1517.0 (151[i])	1508.0 (157[j])
SD	286.0 (17)	287.0 (27)	428.0 (26)	428.0 (27)
Minimum	494.0 (93)	516.0 (89)	904.0 (100)	826.0 (109)
5%	675.0 (95)	516.0 (89)	961.0 (117)	1011.0 (121)
25%	1016.0 (112)	979.0 (109)	1254.0 (133)	1184.0 (138)
50%	1160.0 (127)	1103.0 (122)	1460.0 (147)	1437.0 (155)
75%	1330.0 (134)	1227.0 (141)	1733.0 (164)	1743.0 (167)
95%	1825.0 (152)	1915.0 (197)	2278.0 (194)	2095.0 (197)
Maximum	1997.0 (159)	1915.0 (197)	3057.0 (237)	2890.0 (253)
WOMEN				
N	31	22	59	36
Mean	933.0 (130[k])	941.0 (134[l])	1192.0 (153[k])	1178.0 (153[l])
SD	303.0 (26)	343.0 (23)	296.0 (26)	410.0 (30)
Minimum	400.0 (72)	590.0 (103)	562.0 (101)	495.0 (94)
5%	415.0 (95)	610.0 (105)	820.0 (117)	546.0 (104)
25%	703.0 (112)	699.0 (114)	982.0 (136)	912.0 (129)
50%	985.0 (131)	870.0 (132)	1148.0 (145)	1104.0 (147)
75%	1191.0 (142)	1008.0 (145)	1349.0 (169)	1369.0 (175)
95%	1439.0 (187)	1431.0 (180)	1818.0 (207)	2013.0 (216)
Maximum	1473.0 (198)	2092.0 (186)	1911.0 (227)	2454.0 (227)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil.
Age group differences: nil.
Centre differences: men 70-79 and 80+; women 70-79 and 80+.

10.3.5 MAGNESIUM

Results: Magnesium intake averaged 200mg/day (25mg/Mj) in Spata and 300mg/day (33mg/Mj) in Melbourne. Gender and age group differences were not significant within centres for magnesium density. However, men had significantly greater absolute intakes than the women. Melbourne men and women in both age groups had a higher magnesium intake and density than Spata elderly (see table 10.3.5).

Table 10.3.5

Magnesium intake mg/day (mg/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	250.0 (26[i])	220.0 (24[j])	340.0 (34[i])	318.0 (32[j])
SD	63.0 (3)	53.0 (3)	98.0 (6)	96.0 (5)
Minimum	105.0 (19)	73.0 (19)	189.0 (22)	151.0 (22)
5%	151.0 (21)	73.0 (19)	209.0 (24)	178.0 (25)
25%	214.0 (24)	196.0 (21)	275.0 (28)	241.0 (28)
50%	247.0 (26)	209.0 (25)	328.0 (33)	286.0 (33)
75%	277.0 (28)	271.0 (27)	389.0 (37)	416.0 (37)
95%	371.0 (31)	287.0 (29)	490.0 (49)	460.0 (39)
Maximum	393.0 (32)	287.0 (29)	666.0 (53)	488.0 (40)
WOMEN				
N	31	22	59	36
Mean	181.0 (25[k])	181.0 (25[l])	267.0 (34[k])	246.0 (32[l])
SD	57.0 (3)	62.0 (2)	69.0 (6)	70.0 (4)
Minimum	81.0 (18)	97.0 (17)	139.0 (23)	119.0 (22)
5%	89.0 (19)	108.0 (19)	162.0 (25)	154.0 (25)
25%	136.0 (22)	139.0 (24)	214.0 (29)	191.0 (27)
50%	188.0 (25)	164.0 (25)	270.0 (33)	235.0 (32)
75%	230.0 (27)	203.0 (27)	313.0 (39)	285.0 (36)
95%	263.0 (29)	314.0 (28)	371.0 (45)	371.0 (39)
Maximum	279.0 (31)	335.0 (29)	484.0 (53)	420.0 (42)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil.
Age group differences: nil.
Centre differences: men 70-79 and 80+; women 70-79 and 80+.

Comparisons with other studies: In the National Dietary survey of adults aged 25-65, mean intake of magnesium in Southern European men (318±10mg/day ±SEM) and women (274±19mg/day ±SEM) were similar to elderly Melbourne Greeks (M 330±97mg/day, F 256±70mg/day). Anglo-Celtic Australian men aged 70-79 in Melbourne had a similar mean magnesium intake (347±104mg/day, 35±7mg/Mj) to elderly Greek men in Melbourne (330±97mg/day, 33±6mg/Mj), but significantly higher values than

Spata men (230±58mg/day, 25±3mg/Mj). Anglo-Celtic women had a significantly higher mean magnesium intake (354±145mg/day, 41±13mg/Mj) than elderly Greek women in Melbourne (256±70mg/day, 33±5mg/Mj) and Spata (181±60mg/day, 25±2mg/Mj). Anglo-Celtic elderly Australians in Adelaide aged 70+ also had similar mean magnesium values (M 318mg/day, F 310mg/day) to the Melbourne Anglo-Celtics. Baghurst and Record (1987) and Horwath (1987) also reported high mean intakes for elderly Australian women: 310-320mg, but found that about 40% of the samples fell below the Australian RDI (see section 10.3.14).

10.3.6 IRON

Results: Iron intake averaged 19mg/day (2.3mg/Mj) in Spata and 22mg/day (2.4mg/Mj) in Melbourne. Gender, age group and centre differences were not significant for iron density or absolute amounts (see table 10.3.6).

Comparisons with reported data: In the Euronut-Seneca study, Markopoulo elderly had slightly lower mean iron intakes (M 16.2±5mg/day, F 11.6±3.5mg/day) than Spata elderly (M 20±9mg/day, F 18±11mg/day). Mean iron densities were also lower (M 1.6±0.4mg/Mj, F 1.3±0.2mg/Mj) than Spata elderly (M 2.2±1mg/Mj, F 2.4±1mg/Mj). In the National Dietary survey of adults aged 25-65, mean intake of iron in Southern European men (15±0.6mg/day ±SEM) and women (12±0.8mg/day ±SEM) were lower than elderly Melbourne Greeks (M 23±12mg/day, F 20±13mg/day).

Anglo-Celtic Australian elderly aged 70-79 in Melbourne had lower mean iron intakes (M 14±5mg/day, F 14.5±7) than elderly Greeks in Melbourne (M 23±12mg/day, F 20±13mg/day). Iron densities were also lower (M 1.4±0.3mg/Mj, F 1.7±0.5mg/Mj) than Melbourne Greeks (M 2.3±1mg/Mj, F 2.5±1.5mg/Mj). Anglo-Celtic elderly Australians in Adelaide aged 70+ had similar iron intakes (M 13.4mg/day, F 12.5mg/day) to the Melbourne Anglo-Celtics.

Table 10.3.6

Iron intake mg/day (mg/Mj)

	SPATA		**MELBOURNE**	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	21.8 (2.4)	18.5 (2.0)	25.6 (2.5)	20.1 (2.1)
SD	10.6 (1.2)	7.4 (0.7)	15.1 (1.3)	9.7 (0.9)
Minimum	9.5 (1.0)	2.9 (0.8)	9.1 (0.9)	6.3 (1.0)
5%	10.7 (1.1)	2.9 (0.8)	10.7 (1.2)	9.7 (1.2)
25%	14.1 (1.6)	14.8 (1.7)	15.4 (1.5)	12.6 (1.4)
50%	18.4 (2.0)	17.2 (1.9)	21.7 (2.1)	17.6 (1.6)
75%	28.1 (2.9)	20.9 (2.6)	31.7 (3.0)	27.0 (2.5)
95%	45.2 (4.6)	38.7 (3.8)	59.7 (5.1)	38.0 (3.8)
Maximum	47.7 (6.9)	38.7 (3.8)	85.6 (7.9)	46.3 (4.3)
WOMEN				
N	31	22	59	36
Mean	19.3 (2.7)	16.3 (2.2)	20.1 (2.5)	20.7 (2.6)
SD	12.3 (1.5)	10.8 (0.9)	10.0 (1.2)	17.0 (1.8)
Minimum	5.9 (1.0)	5.2 (1.0)	7.2 (1.0)	5.2 (0.9)
5%	7.6 (1.1)	5.3 (1.1)	8.0 (1.2)	5.6 (0.9)
25%	11.5 (1.7)	9.5 (1.5)	10.9 (1.5)	10.5 (1.5)
50%	15.7 (2.1)	12.0 (2.0)	18.0 (2.3)	15.6 (2.2)
75%	22.5 (3.3)	18.6 (2.5)	27.5 (3.2)	24.6 (2.9)
95%	46.5 (6.2)	39.4 (3.8)	40.9 (4.8)	70.7 (7.2)
Maximum	66.6 (7.5)	41.3 (4.5)	42.4 (6.8)	81.9 (9.1)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil. *Age group differences:* nil. *Centre differences:* nil.

10.3.7 ZINC

Results: Zinc intake averaged 14mg/day (1.6mg/Mj) in Spata and 17mg/day (1.9mg/Mj) in Melbourne. Gender and age group differences were not significant within centres for zinc density. However, men had greater absolute intakes than the women. Melbourne men and women aged 70-79 had a higher mean zinc intake and density than Spata elderly (see table 10.3.7).

Table 10.3.7

Zinc intake mg/day (mg/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	14.7 (1.5[i])	15.1 (1.7)	20.0 (2.0[i])	17.0 (1.8)
SD	3.9 (0.4)	6.3 (0.6)	6.9 (0.5)	5.1 (0.5)
Minimum	8.3 (0.8)	5.0 (0.9)	7.2 (0.9)	7.8 (1.2)
5%	8.4 (1.0)	5.0 (0.9)	12.3 (1.2)	8.7 (1.2)
25%	11.9 (1.3)	11.9 (1.3)	15.0 (1.6)	13.8 (1.4)
50%	14.7 (1.4)	15.2 (1.6)	18.3 (1.9)	15.9 (1.6)
75%	17.1 (1.8)	17.2 (1.8)	22.8 (2.2)	20.0 (2.0)
95%	20.1 (2.2)	37.2 (3.8)	36.5 (3.2)	24.0 (2.6)
Maximum	25.8 (3.0)	37.2 (3.8)	38.8 (3.5)	31.3 (4.0)
WOMEN				
N	31	22	59	36
Mean	12.2 (1.7[k])	12.8 (1.8)	15.4 (1.9[k])	13.9 (1.8)
SD	4.5 (0.4)	5.2 (0.3)	4.9 (0.4)	5.4 (0.4)
Minimum	4.4 (0.8)	7.0 (1.2)	7.7 (1.2)	4.8 (0.8)
5%	4.8 (1.0)	8.0 (1.3)	8.8 (1.2)	6.5 (1.1)
25%	9.7 (1.4)	9.0 (1.6)	11.9 (1.6)	9.9 (1.4)
50%	12.3 (1.7)	10.9 (1.7)	14.4 (1.9)	12.8 (1.8)
75%	15.2 (2.1)	14.1 (2.0)	19.0 (2.2)	16.0 (2.0)
95%	21.8 (2.4)	24.1 (2.1)	23.8 (3.0)	25.5 (2.7)
Maximum	23.1 (2.5)	24.7 (2.3)	31.7 (3.2)	25.5 (2.8)

Same pair of letters show significant differences, Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil.
Age group differences: nil.
Centre differences: men 70-79; women 70-79.

Comparisons with reported data: In the National Dietary survey of adults aged 25-65, mean intakes of zinc in Southern European men (13±0.8mg/day ±SEM) and women (13±1.9mg/day ±SEM) were lower than elderly Melbourne Greeks (M 18±6mg/day, F 15±5mg/day), but similar to levels in Spata (M 14.9±5mg/day, F 12.5±5mg/day). Anglo-Celtic Australian elderly aged 70-79 in Melbourne had lower mean zinc intakes (M 13.8±5mg/day, F 13±5) than elderly Greeks in Melbourne. Zinc densities were also lower (M 1.4±0.3mg/Mj, F 1.5±0.4mg/Mj) than Melbourne Greeks (M 1.9±0.5mg/Mj, F 1.9±0.4mg/Mj) but similar to Spata elderly (M 1.6±0.5mg/Mj, F 1.7±0.4mg/Mj). Anglo-Celtic elderly Australians in Adelaide aged 70+ (Horwath, 1997) had similar zinc intakes (M 10mg/day, F 9.5mg/day) to the Melbourne Anglo-Celtics.

10.3.8 VITAMIN A

Vitamin A activity of the diet is usually expressed as retinol equivalents. This is calculated by adding to the retinol content, one-sixth of the b-carotene content.

i. Vitamin A (Retinol Equivalents)

Results: Vitamin A intake averaged 620µg/day (80µg/Mj) in Spata and 960µg/day (108µg/Mj) in Melbourne. Gender and age group differences were not significant in Spata. In Melbourne, the women aged 70-79 had a greater vitamin density (113±43µg/Mj) compared with the men (104µg/Mj). Melbourne men aged 70-79 and women aged 70-79 & 80+ had a greater vitamin A density and absolute intake than Spata elderly.

Table 10.3.8a

Vitamin A intake retinol equivalents µg/day (µg/Mj)
(vitamin A = retinol + carotene/6)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	723.3 (77[i])	732.3 (85)	1028.4 (101[ci])	1032.5 (107)
SD	444.3 (46)	506.3 (62)	510.3 (41)	412.9 (36)
Minimum	209.3 (22)	188.5 (28)	368.9 (41)	396.5 (53)
5%	248.0 (31)	188.5 (28)	452.4 (58)	402.0 (56)
25%	435.4 (48)	396.7 (43)	538.4 (75)	700.9 (81)
50%	594.6 (66)	571.1 (63)	644.6 (92)	920.9 (108)
75%	855.8 (97)	988.8 (99)	945.1 (116)	1308.3 (127)
95%	1560.2 (135)	2268.9 (286)	1254.8 (168)	1664.6 (180)
Maximum	2287.9 (270)	2268.0 (286)	2097.3 (252)	1947.3 (188)
WOMEN				
N	31	22	59	36
Mean	495.2 (67[k])	515.3 (75[l])	941.0 (119[ck])	826.7 (107[l])
SD	292.6 (32)	241.0 (32)	377.8 (40)	419.1 (46)
Minimum	88.0 (17)	252.6 (34)	211.0 (44)	183.5 (32)
5%	165.4 (28)	291.6 (36)	418.9 (70)	198.0 (32)
25%	292.4 (44)	315.6 (55)	633.4 (86)	508.8 (72)
50%	417.0 (58)	451.9 (65)	923.8 (111)	826.7 (101)
75%	590.8 (79)	648.4 (82)	1179.8 (144)	1028.6 (146)
95%	1121.4 (129)	841.5 (132)	1587.5 (201)	1845.2 (206)
Maximum	1162.2 (146)	1220.2 (166)	1994.8 (214)	2196.9 (220)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: Melbourne 70-79.
Age group differences: nil. *Centre differences:* men 70-79; women 70-79 and 80+.

Comparisons with reported data: In the Euronut-Seneca study, Greek elderly had similar vitamin A intakes (M 876±554 RE/day, F 629±402 RE/day) to Spata elderly (M 727±472 RE/day, F 505±266 RE/day). Mean vitamin densities were also similar (M 75±40 RE/Mj, F 90±58 RE/Mj) to Spata elderly (M 81±49 RE/Mj, F 71±32 RE/Mj). In the National Dietary survey of adults aged 25-65, mean intake of vitamin A in Southern European men (900±90 RE/day ±SEM) were similar to Greek men in Melbourne (1030±461 RE/day). Southern European women had significantly greater intakes (1510±370 RE/day) than the Greek women in Melbourne (883±398 RE/day).

Anglo-Celtic subjects aged 70-79 in Melbourne had similar mean vitamin A intakes (M 1210±584 RE/day, F 1115±360) to elderly Greeks in Melbourne. However, vitamin A densities were significantly greater (M 123±50 RE/Mj, F 133±42 RE/Mj) than Melbourne Greeks (M 104±38 RE/Mj, F 113±43 RE/Mj). Anglo-Celtic elderly Australians in Adelaide aged 70+ (Horwath, 1997) had even higher mean vitamin A intakes (M 2100 RE/day, F 2000 RE/day) than the Melbourne Anglo-Celtics.

ii. Retinol

Results: Retinol intake averaged 330µg/day (40µg/Mj) in Spata and 360µg/day (41µg/Mj) in Melbourne. Gender, age group and centre differences were not significant (see table 10.3.8b).

Comparisons with reported data: In the elderly Anglo-Celtic Australian study in Melbourne, mean absolute intake of retinol (M 449±215 µg/day, F 384±155µg/day) was similar to Melbourne (M 372±307 µg/day, F 348±293 µg/day) and Spata Greeks (M 409±445 µg/day, F 250±197 µg/day). Mean retinol densities of the Anglo-Celtics (M 45±16 µg/Mj, F 45±15 µg/Mj) were also similar to Melbourne (M 37±28 µg/Mj, F 45±35 µg/Mj) and Spata Greeks (M 46±52 µg/Mj, F 35±29 µg/Mj).

iii. Carotene

Results: Carotene intake averaged 1720µg/day (210µg/Mj) in Spata and 3580µg/day (400µg/Mj) in Melbourne. In Spata, gender and age group differences were not significant for carotene density. However, men consumed greater absolute amounts of carotene. In Melbourne, the women aged 70-79 had a greater carotene density than the men aged 70-79 and the women aged 80+. Melbourne men and women in both age groups had a higher carotene intake and density than Spata elderly (see table 10.3.8c).

Comparisons with reported data: In the Euronut-Seneca study, Cretan elderly had lower mean carotene intakes (M 1267µg/day, F 849µg/day) than Spata elderly (M 1907±935µg/day, F 1530±840µg/day). Mean carotene densities were also lower (M 122µg/Mj, F 138µg/Mj) than Spata elderly (M 208±90µg/Mj, F 211±84µg/Mj). Anglo-Celtic Australian elderly aged 70-79 in Melbourne (IUNS) had higher carotene intakes (M 4550±2903µg/day, F 4373±1888µg/day) than elderly Greeks in Melbourne (M 3947±1760µg/day, F 3200±1700µg/day). Carotene densities were similar for the Anglo-Celtic men (469±282µg/Mj) and Greek men (400±153µg/Mj) but not the women (Anglo-Celtic 530±246µg/Mj; Greeks 410±190 µg/Mj).

Table 10.3.8b

Retinol intake µg/day (µg/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	391.0 (42)	427.0 (51)	375.0 (37)	369.0 (37)
SD	395.0 (43)	495.0 (62)	344.0 (33)	270.0 (23)
Minimum	82.0 (7)	103.0 (11)	56.0 (5)	91.0 (9)
5%	83.0 (9)	103.0 (11)	96.0 (10)	131.0 (14)
25%	145.0 (17)	130.0 (14)	147.0 (15)	196.0 (21)
50%	263.0 (29)	213.0 27()	285.0 (26)	254.0 (28)
75%	452.0 (55)	622.0 (64)	418.0 (42)	458.0 (51)
95%	1017.0 (88)	2042.0 (257)	1226.0 (86)	974.0 (80)
Maximum	2025.0 (241)	2042.0 (257)	1765.0 (190)	1126.0 (104)
WOMEN				
N	31	22	59	36
Mean	242.0 (33)	258.0 (38)	344.0 (43)	353.0 (47)
SD	215.0 (27)	179.0 (31)	273.0 (33)	313.0 (38)
Minimum	37.0 (4)	72.0 (14)	87.0 (10)	72.0 (8)
5%	49.0 (8)	84.0 (14)	98.0 (14)	78.0 (10)
25%	102.0 (15)	120.0 (20)	147.0 (22)	145.0 (21)
50%	169.0 (22)	205.0 (25)	241.0 (29)	252.0 (29)
75%	273.0 (51)	363.0 (44)	461.0 (57)	428.0 (65)
95%	730.0 (84)	625.0 (104)	1093.0 (106)	965.0 (148)
Maximum	736.0 (108)	634.0 (132)	1265.0 (173)	1639.0 (164)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil. *Age group differences:* nil. *Centre differences:* nil.

Table 10.3.8c

Carotene intake µg/day (µg/Mj)

	SPATA		**MELBOURNE**	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	1988.0 (211[i])	1827.0 (206[j])	3919.0 (386[di])	3975.0 (416[j])
SD	886.0 (82)	984.0 (101)	1885.0 (149)	1638.0 (158)
Minimum	570.0 (50)	509.0 (97)	1183.0 (146)	1229.0 (174)
5%	613.0 (90)	509.0 (97)	1592.0 (191)	1344.0 (213)
25%	1416.0 (145)	1237.0 (138)	2635.0 (287)	2748.0 (277)
50%	1799.0 (199)	1594.0 (168)	3704.0 (362)	3546.0 (394)
75%	2443.0 (266)	2022.0 (261)	4537.0 (449)	5452.0 (531)
95%	3719.0 (360)	4495.0 (462)	7877.0 (643)	6711.0 (750)
Maximum	3753.0 (436)	4495.0 (462)	11286.0 (999)	7235.0 (759)
WOMEN				
N	31	22	59	36
Mean	1515.0 (206[k])	1543.0 (217[l])	3577.0(455[dhk])	2840.0(363[hl])
SD	813.0 (86)	871.0 (82)	1676.0 (202)	1778.0 (185)
Minimum	160.0 (32)	587.0 (70)	612.0 (104)	228.0 (37)
5%	364.0 (74)	633.0 (97)	666.0 (127)	413.0 (72)
25%	1000.0 (133)	1051.0 (172)	2443.0 (316)	1714.0 (244)
50%	1400.0 (226)	1275.0 (216)	3355.0 (428)	2467.0 (333)
75%	1916.0 (254)	1799.0 (263)	4351.0 (519)	3882.0 (458)
95%	2815.0 (337)	2718.0 (362)	6945.0 (974)	5367.0 (736)
Maximum	3965.0 (440)	4209.0 (397)	8929.0 (1116)	10052.0 (1027)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: Spata nil; Melbourne 70-79.
Age group differences: Spata nil; Melbourne women.
Centre differences: men 70-79 and 80+; women 70-79 and 80+.

10.3.9 THIAMIN

Since thiamin is involved in carbohydrate metabolism, its requirement depends on overall energy intake; thus the thiamin requirement should decrease in the elderly because of their lower energy expenditure.

Results: Thiamin intake averaged 0.7mg/day (0.09mg/Mj) in Spata and 1.1mg/day (0.13mg/Mj) in Melbourne. Gender and age group differences were seen in Spata only - the women aged 80+ had a greater thiamin density than the men 80+; the men aged 70-79 had a greater thiamin density than the 80+ men. Melbourne men had significantly greater absolute intakes than the women. Melbourne elderly had a greater absolute intake and density than Spata elderly (see table 10.3.9).

Table 10.3.9

Thiamin intake mg/day (mg/Mj)

	SPATA		**MELBOURNE**	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	0.9 (0.1[ei])	0.7 (0.08[bej])	1.3 (0.13[i])	1.2 (0.13[j])
SD	0.3 (0.01)	0.2 (0.01)	0.5 (0.04)	0.3 (0.03)
Minimum	0.4 (0.07)	0.3 (0.06)	0.6 (0.08)	0.6 (0.08)
5%	0.5 (0.07)	0.3 (0.06)	0.7 (0.09)	0.7 (0.09)
25%	0.7 (0.08)	0.7 (0.07)	0.9 (0.10)	1.0 (0.11)
50%	0.9 (0.09)	0.7 (0.08)	1.2 (0.12)	1.1 (0.13)
75%	0.9 (0.10)	0.8 (0.09)	1.4 (0.14)	1.5 (0.14)
95%	1.4 (0.12)	1.1 (0.11)	2.5 (0.19)	1.7 (0.18)
Maximum	1.6 (0.12)	1.1 (0.11)	2.7 (0.24)	2.0 (0.19)
WOMEN				
N	31	22	59	36
Mean	0.7 (0.09[k])	0.7 (0.09[bl])	1.0 (0.13[k])	0.9 (0.12[l])
SD	0.2 (0.01)	0.2 (0.01)	0.3 (0.03)	0.3 (0.02)
Minimum	0.3 (0.07)	0.3 (0.07)	0.6 (0.09)	0.4 (0.08)
5%	0.3 (0.07)	0.4 (0.07)	0.6 (0.09)	0.5 (0.09)
25%	0.5 (0.08)	0.5 (0.09)	0.8 (0.11)	0.7 (0.11)
50%	0.7 (0.09)	0.6 (0.09)	0.9 (0.13)	0.9 (0.12)
75%	0.8 (0.10)	0.8 (0.10)	1.2 (0.14)	1.1 (0.14)
95%	0.9 (0.11)	1.1 (0.11)	1.7 (0.18)	1.4 (0.16)
Maximum	1.0 (0.11)	1.2 (0.14)	1.8 (0.20)	1.6 (0.18)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: Spata 80+; Melbourne nil.
Age group differences: Spata men; Melbourne nil.
Centre differences: men 70-79 and 80+; women 70-79 and 80+.

Comparisons with reported data: In the Euronut-Seneca study, Cretan elderly had greater thiamin intakes (M 1.4±0.5 mg/day, F 0.83±0.2mg/day) than Spata elderly (M 0.8±0.09mg/day, F 0.7±0.2 mg/day). Mean thiamin densities were also greater (M 0.1±0.03mg/Mj, F 0.1±0.03mg/Mj) than Spata elderly (M 0.09±0.01 mg/Mj, F 0.09±0.01 mg/Mj). In the National Dietary survey of adults aged 25-65, mean intake of thiamin in Southern Europeans (M 1.1±0.05 mg/day F 1±0.09 mg/day ±SEM) were similar to Greek elderly in Melbourne (M 1.3±0.1mg/day, F 1±0.1mg/day). Anglo-Celtic Australian elderly aged 70-79 in Melbourne (IUNS) had significantly greater mean thiamin intakes (M 2.3±2.1 mg/day, F 2.0±1.4) than elderly Greeks in Melbourne. Mean thiamin densities were also significantly greater (M 0.2±0.2 mg/Mj, F 0.2±0.1 mg/Mj) than Melbourne Greeks (M 0.1±0.03 mg/Mj, F 0.1±0.02 mg/Mj). Anglo-Celtic elderly Australians in Adelaide aged 70+ (Horwath, 1987) had similar mean thiamin intakes (M 1.24mg/day, F 1.15 mg/day) to Melbourne Greeks.

10.3.10 RIBOFLAVIN

Results: Riboflavin intake averaged 1.1mg/day (0.14mg/Mj) in Spata and 1.6mg/day (0.18mg/Mj) in Melbourne. Gender and age group differences were not significant within centres for riboflavin density. However, men had higher absolute intakes than women. Melbourne men and women in both age groups had a greater riboflavin intake and density than Spata elderly (see table 10.3.10).

Table 10.3.10

Riboflavin intake mg/day (mg/Mj)

	SPATA		**MELBOURNE**	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	1.3 (0.14[i])	1.3 (0.15[j])	1.8 (0.18[i])	1.8 (0.19[j])
SD	0.4 (0.03)	0.4 (0.04)	0.6 (0.05)	0.7 (0.06)
Minimum	0.7 (0.08)	0.5 (0.10)	0.9 (0.10)	0.9 (0.11)
5%	0.7 (0.08)	0.5 (0.10)	1.0 (0.13)	0.9 (0.13)
25%	0.9 (0.11)	1.1 (0.12)	1.4 (0.15)	1.3 (0.15)
50%	1.2 (0.14)	1.2 (0.15)	1.7 (0.17)	1.7 (0.18)
75%	1.5 (0.16)	1.5 (0.18)	2.0 (0.20)	2.1 (0.22)
95%	2.3 (0.18)	2.6 (0.27)	3.1 (0.27)	2.9 (0.33)
Maximum	2.4 (0.18)	2.6 (0.27)	4.0 (0.33)	3.9 (0.35)
WOMEN				
N	31	22	59	36
Mean	1.0 (0.14[k])	1.1 (0.16[l])	1.4 (0.18[k])	1.4 (0.18[l])
SD	0.3 (0.04)	0.4 (0.04)	0.4 (0.04)	0.4 (0.04)
Minimum	0.4 (0.08)	0.5 (0.10)	0.6 (0.11)	0.5 (0.10)
5%	0.4 (0.09)	0.7 (0.11)	0.9 (0.13)	0.6 (0.11)
25%	0.8 (0.11)	0.8 (0.13)	1.1 (0.15)	1.1 (0.15)
50%	1.1 (0.15)	1.0 (0.15)	1.4 (0.17)	1.3 (0.18)
75%	1.3 (0.16)	1.3 (0.19)	1.7 (0.21)	1.7 (0.21)
95%	1.4 (0.23)	1.5 (0.22)	2.1 (0.27)	2.2 (0.24)
Maximum	1.6 (0.27)	2.6 (0.25)	2.7 (0.29)	2.4 (0.26)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil.
Age group differences: nil.
Centre differences: men 70-79 and 80+; women 70-79 and 80+.

Comparisons with reported data: In the Euronut study, riboflavin intakes of Cretan elderly were similar (M 1.4mg/day, F 0.9mg/day) to Spata elderly (M 1.3mg/day, F 1.0mg/day). In the National Dietary survey of adults aged 25-65, mean riboflavin intakes of Southern Europeans (M 1.61±0.07 mg/day F 1.6±0.18 mg/day ±SEM) were similar to Greek elderly in Melbourne (M 1.8±0.06mg/day, F 1.4±0.4mg/day). Anglo-Celtic Australian elderly aged 70-79 in Melbourne had significantly greater mean riboflavin intakes (M 3.1±2.5 mg/day, F 2.9±2.3) than elderly Greeks in Melbourne. Mean riboflavin densities were also significantly greater (M 0.33±0.28 mg/Mj, F 0.33±0.2 mg/Mj) than Melbourne Greeks (M 0.18±0.05 mg/Mj, F 0.18±0.04 mg/Mj). Anglo-Celtic elderly in Adelaide aged 70+ (Horwath, 1997) had similar mean intakes (M 2.15mg/day, F 2.06 mg/day) to Melbourne Anglo-Celtics.

10.3.11 NIACIN

Results: Niacin intake (niacin equivalents, NE) averaged 27mg/day (3.3mg/Mj) in Spata and 37mg/day (4.3mg/Mj) in Melbourne. Gender and age group differences were not significant within centres for niacin density. However, men had greater absolute intakes than the women. Melbourne men and women in both age groups had a higher niacin intake and density than Spata elderly (see table 10.3.11).

Comparisons with reported data: In the National Dietary survey of adults aged 25-65, mean intakes of niacin in Southern Europeans (M 34.9±1.4 mg/day F 28.7±1.5 mg/day ±SEM) were lower than Greek elderly in Melbourne (M 42±11 mg/day, F 32±9mg/day), but similar to Spata elderly (M 30±8, F 23±8 mg/day). Anglo-Celtic Australian elderly aged 70-79 in Melbourne had significantly greater mean niacin intakes (M 49±23 mg/day, F 44±19) compared with elderly Greeks in Melbourne. Mean niacin densities were also significantly greater (M 5±2 mg/Mj, F 5±1.4 mg/Mj) than Melbourne (4.3±0.7 mg/Mj) and Spata (3.3±0.6 mg/Mj) Greeks. However, Anglo-Celtic elderly Australians in Adelaide aged 70+ had similar mean niacin intakes (M 36mg/day, F 33.5 mg/day) to Melbourne Greeks.

Table 10.3.11

Niacin intake (niacin equivalents) mg NE/day (mg NE/Mj)
(niacin equivalents = niacin + (protein x 0.16)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	31.7 (3.4^{i})	28.5 (3.2^{j})	44.3 (4.4^{i})	40.6 (4.3^{j})
SD	7.7 (0.5)	8.9 (0.8)	11.3 (0.7)	10.4 (0.8)
Minimum	12.4 (2.4)	12.1 (2.2)	24.8 (2.9)	23.1 (3.1)
5%	20.0 (2.6)	12.1 (2.2)	27.7 (3.5)	26.2 (3.3)
25%	26.0 (2.9)	25.2 (2.7)	36.4 (3.9)	33.7 (3.7)
50%	32.0 (3.3)	27.8 (3.2)	44.9 (4.4)	38.6 (4.2)
75%	35.9 (3.6)	30.9 (3.3)	50.2 (4.9)	47.9 (4.8)
95%	47.4 (4.3)	55.8 (5.7)	66.9 (5.7)	58.9 (5.5)
Maximum	49.2 (4.5)	55.8 (5.7)	77.9 (6.2)	62.6 (6.4)
WOMEN				
N	31	22	59	36
Mean	23.7 (3.3^{k})	23.4 (3.3^{l})	33.9 (4.4^{k})	31.2 (4.1^{l})
SD	8.0 (0.6)	8.1 (0.6)	9.4 (0.9)	9.0 (0.7)
Minimum	9.5 (2.0)	13.5 (2.4)	16.2 (2.9)	14.8 (2.6)
5%	11.2 (2.4)	14.2 (2.4)	20.4 (2.9)	15.7 (2.9)
25%	17.2 (2.9)	18.3 (2.9)	27.5 (3.7)	25.5 (3.6)
50%	25.0 (3.3)	21.3 (3.1)	31.9 (4.3)	30.6 (4.1)
75%	30.1 (3.6)	26.0 (3.8)	39.1 (4.8)	35.2 (4.6)
95%	37.9 (4.2)	37.2 (4.5)	51.3 (6.6)	48.2 (5.7)
Maximum	38.0 (4.6)	45.1 (5.0)	68.0 (6.8)	57.2 (5.9)

Same pair of letters show significant differences,Wilcoxon p<0.05:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil.
Age group differences: nil.
Centre differences: men 70-79 and 80+; women 70-79 and 80+.

10.3.12 VITAMIN C

Results: Vitamin C intake averaged 75mg/day (9.6mg/Mj) in Spata and 150mg/day (17mg/Mj) in Melbourne. Gender and age group differences were not significant within centres for absolute intakes and density. Melbourne men and women in both age groups had a higher vitamin C intake and density than Spata elderly (see table 10.3.12).

Table 10.3.12

Vitamin C intake mg/day (mg/Mj)

	SPATA		MELBOURNE	
	70 - 79	80 +	70 - 79	80 +
MEN				
N	32	19	66	28
Mean	86.9 (9.3[i])	73.8 (8.9[j])	171.9 (17.5[i])	150.5 (16.1[j])
SD	34.8 (2.9)	21.5 (4.5)	72.9 (7.3)	81.0 (9.2)
Minimum	29.1 (2.6)	26.6 (3.3)	47.5 (5.9)	342.4 (6.9)
5%	38.2 (4.5)	26.6 (3.3)	76.3 (8.3)	56.8 (7.3)
25%	60.6 (6.9)	57.7 (6.2)	123.4 (11.4)	106.3 (10.5)
50%	80.8 (9.8)	68.2 (8.2)	157.7 (16.5)	136.4 (13.4)
75%	108.0 (11.6)	88.8 (10.0)	208.2 (22.0)	168.4 (19.2)
95%	149.6 (13.2)	113.2 (24.8)	338.7 (30.2)	386.3 (38.0)
Maximum	180.9 (15.9)	113.2 (24.8)	396.8 (40.1)	418.2 (48.9)
WOMEN				
N	31	22	59	36
Mean	73.6 (10.2[k])	68.5 (10.1[l])	147.3 (18.4[k])	123.9 (15.9[l])
SD	32.3 (3.5)	36.5 (6.6)	68.5 (6.8)	65.3 (6.0)
Minimum	9.2 (1.8)	27.8 (4.6)	24.4 (3.8)	47.5 (7.8)
5%	24.6 (4.2)	31.2 (5.0)	51.8 (8.5)	55.2 (8.4)
25%	50.0 (8.1)	41.1 (6.7)	92.6 (12.9)	78.6 (11.1)
50%	72.7 (10.1)	57.1 (9.2)	135.5 (18.0)	104.7 (14.3)
75%	95.6 (12.4)	90.1 (10.4)	193.2 (22.8)	155.4 (20.1)
95%	113.2 (16.2)	130.0 (14.4)	301.3 (32.0)	256.6 (29.9)
Maximum	166.2 (18.4)	178.6 (37.6)	318.9 (36.6)	353.2 (31.1)

Same pair of letters show significant differences,Wilcoxon $p<0.05$:
a,b,c or d within centres - between gender for a given age group
e,f,g or h within centres - between age groups for a given gender
i,j,k or l between centres - for a given age group and gender
**Statistics performed on nutrient densities in order to control for energy intake.*
Gender differences: nil. *Age group differences:* nil.
Centre differences: men 70-79 and 80+; women 70-79 and 80+.

Comparisons with reported data: In the Euronut study, Cretan elderly had higher vitamin C intakes (M 175±76 mg/day, F 123±82mg/day) than Spata elderly (M 80±28mg/day, F 70±34 mg/day). Mean densities were also greater (M 16±7mg/Mj, F 17±12mg/Mj) than Spata elderly (M 9±3 mg/Mj, F 10±5 mg/Mj). In the National Dietary survey of adults aged 25-65, mean intake of vitamin C in Southern Europeans (M 120±18 mg/day F 119±9 mg/day ±SEM) were lower than Greek elderly in Melbourne (M 161±77 mg/day, F 135±66 mg/day). Anglo-Celtic Australian elderly aged 70-79 in Melbourne had similar mean vitamin C intakes (M 171±86 mg/day, F 171±74) to elderly Greeks in Melbourne. Mean vitamin C densities were also similar (M 18±9 mg/Mj, F 20±9 mg/Mj) to Melbourne Greeks (M 17±8 mg/Mj, F 17±6 mg/Mj). Anglo-Celtic elderly Australians in Adelaide aged 70+ had lower mean vitamin C intakes (M 87 mg/day, F 98 mg/day) than Melbourne Greeks.

10.3.13 VITAMINS B6, B12, D, E, FOLATE

Vitamins B6, B12, D, E and folate were not available in the Australian food tables, therefore, the literature will be presented instead. However, blood levels of folate and B12 were measured in elderly Greeks (see also Chapter 11).

a) Pyridoxine

A number of studies have reported that about 20-54% of elderly men and 45-78% of elderly women consume less than 1.0 mg (Lonergan et al., 1975; DHSS, 1979; Garry et al., 1982a,b; Morgan and Zabik). In a large American survey (McGandy et al., 1986), 54-74% of men had intakes below 1.5mg and 67-75% of women had intakes below 1.4mg. In Australia, Horwath (1987) reported intakes below 1.5mg in 70% of men and below 1.1mg in 31% of women. Very similar results were reported by Baghurst and Record (1987) on Anglo-Celtic Australian elderly. In the Euronut study (de Groot et al., 1991), a more than 20% of the men (not women) in 5 out of 13 centres had B6 intakes below the lowest European RDI (32% of elderly Greek men on Crete had intakes below the RDI); biochemical evidence of B6 deficiency was found in 23% of all subjects in the study. Although vitamin B6 intake could not be computed for Spata and Melbourne elderly, their high intakes of pyridoxine rich foods, namely fish and meat (see chapter 9), suggests that consumption of this nutrient is probably adequate.

b) Cobalamin

In the majority of studies, vitamin B12 has not been found to be inadequately consumed by elderly people (Horwath, 1989a). In free-living middle to upper-class US elderly, 24% of the men and 39% of the women had B12 intakes below three fourths of the RDA (Ahmed, 1992), most of whom were able to maintain normal levels of serum B12 despite intakes below the RDI. The usual cause of deficiency is loss of intrinsic factor in the stomach in pernicious anaemia. The recommended absolute minimal amount below which there is manifest risk of the development of a deficiency condition is 50µg (Roe, 1983). According to plasma levels, less than 10% of the elderly in Spata and Melbourne appeared to be at high risk of B12 deficiency. Nevertheless, consumption of B12 rich foods (meat and dairy products) was high amongst elderly Greeks. The percentage of Anglo-Celtic elderly (Wahlqvist et al., in press) and Greek elderly in the Euronut study (de Groot et al., 1991) found to have low plasma B12 levels (<111pmol/l) was less than 3%.

c) Folate

Reports of dietary folate intake are scarce because of the difficulty in estimating the folate content of foods. Estimates vary widely due to differences in assay methods and because folate does not occur in food in a single form but in both 'free' and 'conjugated' forms. Additionally, it is readily destroyed by sunlight, oxidation and cooking (Horwath, 1989a). Folate deficiency, is most commonly due to a low intake of dietary folate. It can also result from malabsorption syndrome, alcoholism, poverty, medications (aspirin, barbiturates, phenytoin, isoniazid, antibiotics), chronically-ill or demented states (Roe, 1983).

In a healthy person, total body stores of folate normally range from 10-20mg and complete cessation of dietary folate will deplete body stores within a few months. However, because energy intake is often reduced in the older age group, folate intake may be marginal or low. The recommended absolute minimal amount of folate intake below which there is manifest risk of the development of a deficiency condition is 50µg (Roe, 1983, 1986).

Mean dietary folate intakes reported in studies have varied widely from 124-160µg (NCS: Borgstrom et al., 1979; Yearick et al., 1980; Garry et al., 1982a,b); Betts and Vivian, 1984) and from 190-292µg (Bailey et al., 1982; McGandy et al., 1986; Baghurst and Record, 1987; Horwath, 1987). Folate intakes below 200µg were found in 30% (Baghurst and Records, 1987) and 60% (Horwath, 1987) of randomly selected South Australians, while 40% of healthy volunteers fell below this level in one American study (Garry et al., 1982a,b). Despite low folate intakes, only 3% to 7% of free-living elderly showed low serum or plasma folate levels (<6nmol/l) and about 6% of the elderly surveyed in NHANES I showed serum folate levels <6 nmol/L.

Several studies have shown folate deficiency (serum folate <3ng/ml) in about 15% of subjects (DHSS, 1972; NCS: Yearick et al., 1980), while others have reported higher (Vir and Love, 1979) and lower (HANES: McLennan, 1973; Borgstrom et al., 1979; Garry et al., 1982a,b) frequencies of deficiency. Plasma folate values have been found to be highly correlated with recent dietary intake; serum folate is therefore best measured using fasting samples (Roe, 1986). Plasma folate less than 6.8ng/ml is considered below normal. In the Euronut-Seneca study, folate status was good in all centres; none of the subjects were at risk of deficiency or had blood levels below 6.8nmol/l (de Groot et al., 1991). Similarly in the current study, only two subjects were found to have plasma levels below 6.8nmol/l. Furthermore, intake of folate-rich foods (mainly leafy greens) was particularly high in the study sample (see chapter 9).

d) Vitamin D

Garry et al (1982b) found that 62% to 74% of the elderly had vitamin D intakes below two thirds of the 1989 RDI of 5 µg/day (200IU). The concentration of 25-hydroxycholecalciferol in plasma declines with age, perhaps because of decreased exposure to sunlight. The reduced level may also be attributable to less efficient synthesis of vitamin D in later life. Housebound elderly persons are advised to increase their exposure to sunlight and supplement their diet with about 10µg per day (Ahmed, 1992). Studies on Anglo-Celtic Australians have not found low levels of vitamin D in the diets or in the blood (Horwath, 1987; Baghurst and Record, 1987). In the current study, none of the subjects were housebound and the majority (90%) reported going out of the house at least four times a week.

e) Vitamin E

The few data available on vitamin E intakes in the elderly are conflicting. About 40% of the elderly surveyed by Garry and Hunt (1986) showed intakes below three fourths of the RDIs. Tocopherol levels seem to be maintained in the plasma and liver of the elderly but to decrease in platelets - probably because of enhanced lipid peroxidation and increased platelet aggregation in later life. Absorption does not change with age, although the effects of increasing dietary intake of vitamin E on tissue lipid peroxidation and platelet levels are still unknown (Vatassey et al., 1983; Ahmed, 1992). In the Euronut-Study (de Groot et al, about 1% of the study sample (mainly men) had very low plasma levels of this vitamin. In the current study, vitamin E intake could not be computed. However, intake of vitamin E rich foods, such as olive oil, was high, especially in Spata.

10.3.14 RECOMMENDED DIETARY INTAKES AND NUTRIENT DENSITIES

In contrast to macronutrient intake, where excess or imbalance is more of a problem, with micronutrients the question of deficiency or inadequate intake assumes importance, particularly in the elderly. The micronutrient adequacy of diets are commonly assessed in relation to the *recommended dietary intakes (RDIs*) or to the *recommended nutrient densities (RNDs)*.

a) Recommended dietary intakes for the elderly

There is an ever-growing body of publications on the vitamin status of the elderly and on recommended allowances and specific metabolic alterations in old age. The currently available data do not allow the definitive conclusion that there is an age-specific vitamin requirement (Heseker and Kubler, 1992; Hegsted, 1989). Therefore, nutrient intakes considered adequate for the elderly are currently based on extrapolation from the better defined requirements of younger adults.

Only in one country (USA) has there been a comprehensive effort to make recommendations for the micronutrients for the older age groups (50+ yrs) (Wahlqvist, 1990, National Research Council, 1989) (see Tables 10.3.16a, 10.3.16b). As standards usually incorporate a wide safety margin to cover individual variability (±2 standard deviations), it cannot be concluded that the nutrient intake of an individual is deficient if (s)he does not obtain the RDI. In addition, as the distribution of requirements for nutrients is usually unknown, it is impossible to estimate the probability that an individual is undernourished. Nevertheless, the greater the proportion of people with intakes below the RDI, the greater the possibility that some individuals may be undernourished for the nutrient in question. Thus assessment of the adequacy of dietary intake by comparison of individual intake results with RDIs provides *only a guide to areas of risk, and not proof of absolute deficiency* (Horwath, 1989a). Many different standards have been used to *assess dietary adequacy* using the RDIs. Most researchers use the accepted *cut-off limits of two thirds of the RDI* (McGandy et al., 1986; Davis et al., 1985; Kohrs et al., 1978; Yearick et al., 1980; Horwath, 1989b; Bianchetti et al., 1990)

b) Recommended Nutrient Densities for the elderly

Since total nutrient intake is correlated with total energy consumption, the nutrient density of the diet is an important consideration (Thomas, 1988). A crucial consideration for micronutrient status is the decline in energy intake with advancing years. In the Australian National Dietary Survey, for men, energy dropped by 550 calories per day from the younger to the older age groups; for women, the drop was not as great (285 calories).

This indicates that foods need to be carefully selected by elderly people in order to meet nutrient requirements with a lower energy intake. If we are to put together information about nutrient intakes and energy intakes we can do so in terms of nutrient densities, which is an expression of the mass of nutrient intake in relation to the energy intake. Recommended nutrient density (RND) is the recommended nutrient intake divided by the recommended energy intake. *RNDs are therefore more specific to the elderly because they take into consideration their reduced energy needs.* The United States has also issued RNDs (see Tables 10.3.14a,b) (Wahlqvist & Flint-Richter, 1988; National Research Council, 1989).

Table 10.3.14a

MINERALS

Recommended Dietary Intakes and Nutrient Densities
United States 51-75 years
(National Research Council, 1989),

	M	F
Weight (Kg)	70	55
Height (cm)	178	163
Energy (Kcal)	2050	1600
Energy (Mj)	8.6	6.7
Sodium (mg)	1100-3300	1100-3300
mg/1000 Kcal	536-1610	687-2060
mg/Mj	128-383	163-490
Potassium (mg)	1875-5625	1875-5625
mg/1000 Kcal	914-2743	1171-3515
mg/Mj	220-653	280-837
Calcium (mg)	800	800
mg/1000 Kcal	390	500
mg/Mj	93	120
Phosphorus (mg)	800	800
mg/1000 Kcal	390	500
mg/Mj	93	120
Magnesium (mg)	350	300
mg/1000 Kcal	170	190
mg/Mj	40	45
Iron (mg)	10	10
mg/1000 Kcal	4.9	6.2
mg/Mj	1.2	1.5
Zinc (mg)	15	15
mg/1000 Kcal	7.3	9.4
mg/Mj	1.7	2.2

Table 10.3.14b **VITAMINS**

Recommended Dietary Intakes and Nutrient Densities
United States 51-75 years
(National Research Council, 1989),

	M	F
Weight (Kg)	70	55
Height (cm)	178	163
Energy (Kcal)	2050	1600
Energy (Mj)	8.6	6.7
Vitamin A (µg RE)	1000	800
µg/1000 Kcal	487	500
µg/Mj	116	119
Vitamin D (µg)	5	5
µg/1000 Kcal	2.4	3.1
µg/Mj	0.57	0.74
Vitamin E (mg TE)	10	8
mg/1000 Kcal	4.8	5.0
mg/Mj	1.2	1.2
Vitamin C (mg)	60	60
mg/1000 Kcal	29	37
mg/Mj	6.9	8.8
Thiamin (mg)	1.2	1.0
mg/1000 Kcal	0.58	0.62
mg/Mj	0.14	0.15
Riboflavin (mg)	1.4	1.2
mg/1000 Kcal	0.68	0.75
mg/Mj	0.16	0.18
Niacin (mg NE)	16	13
mg/1000 Kcal	7.8	8.1
mg/Mj	1.8	1.9
Vitamin B6 (mg)	2.2	2.0
mg/1000 Kcal	1.0	1.2
mg/Mj	0.24	0.28
Folacin (µg)	400	400
µg/1000 Kcal	195	250
µg/Mj	46	59
Vitamin B12 (µg)	3.0	3.0
µg/1000 Kcal	1.4	1.87
µg/Mj	0.3	0.45

A. MINERALS

The percentage of subjects below two thirds of the RDIs and RNDs for minerals are shown in tables 10.3.14c,d,e.

Table 10.3.14c

Safe/adequate range for sodium
(non-discretionary only)

	SPATA		MELBOURNE	
	70-79 (%)	80+ (%)	70-79 (%)	80+ (%)
MEN				
N	32	19	66	28
<1100 (<48mmol)	3.1	10.5	11.5	0.0
1100-3300mg (48-144mmol)	87.5	84.2	90.9	100.0
>3300mg (>144mmol)	9.4	5.3	7.6	0.0
WOMEN				
N	31	22	59	36
<1100mg (<48mmol)	16.1	36.4	8.5	19.4
1100-3300mg (48-144mmol)	83.9	59.1	86.4	80.6
>3300mg (>144mmol)	0.0	4.5	5.1	0

Chi-Square was used to test for differences in categories (general associations) between gender, age group or centre, significance level at 5%.
Gender differences: Spata 80+; Melbourne 80+.
Age group differences: Spata women.
Centre differences: women 80+.

Table 10.3.14d

Safe/adequate range for potassium

	SPATA		MELBOURNE	
	70-79 (%)	80+ (%)	70-79 (%)	80+ (%)
MEN				
N	32	19	66	28
<1875mg (<48mmol)	9.4	21.1	0.0	3.6
1875-5625mg (48-144mmol)	90.6	78.9	97.0	92.9
>5625mg (>144mmol)	10.0	0.0	3.0	3.6
WOMEN				
N	31	22	59	36
<1875mg (<48mmol)	35.5	54.5	8.5	13.9
1875-5625mg (48-144mmol)	64.5	45.5	91.5	86.1
>5625mg (>144mmol)	0.0	0.0	0.0	0

Chi-Square was used to test for differences in categories (general associations) between gender, age group or centre, significance level at 5%.
Gender differences: Spata 70-79 and 80+; Melbourne 70-79.
Age group differences: nil.
Centre differences: men 70-79; women 70-79 and 80+.

Table 10.3.14e

The % below two thirds of the US RDI's for Minerals
(% below recommended RND)

	SPATA		MELBOURNE	
	70-79 <0.7 RDI (<RND)	80+ <0.7 RDI (<RND)	70-79 <0.7 RDI (<RND)	80+ <0.7 RDI (<RND)
MEN				
N	32	19	66	28
Calcium (mg)	25.0 (81)	21.1 (58)	19.7 (74)	14.3 (61)
Phosphorus (mg)	3.1 (0)	5.3 (5)	0.0 (0)	0.0 (0)
Magnesium (mg)	43.7 (97)	57.9 (100)	12.1 (80)	17.9 (96)
Iron (mg)	0.0 (16)	5.3 (5)	0.0 (4)	3.6 (3)
Zinc (mg)	12.5 (69)	10.5 (53)	3.0 (32)	7.1 (57)
WOMEN				
N	31	22	59	36
Calcium (mg)	38.7 (90)	50.0 (91)	25.4 (93)	30.6 (67)
Phosphorus (mg)	16.1 (35)	0.0 (32)	0.0 (7)	2.8 (11)
Magnesium (mg)	54.8 (100)	72.7 (95)	16.9 (95)	27.8 (100)
Iron (mg)	3.2 (16)	13.6 (23)	0.0 (18)	5.6 (25)
Zinc (mg)	29.0 (80)	36.4 (95)	13.6 (72)	27.8 (53)

i. Sodium

Results: The majority of the Greek elderly (84%) had sodium intakes (non-discretionary only) within the recommended range (1100-3300mg/day). However, significantly more Spata (36%) and Melbourne women (19%) aged 80+ had intakes below the recommended level (<1100mg/day) (see table 10.3.14c).

Comparisons with reported data: A greater proportion of Anglo-Celtic elderly aged 70-79 (40%) in Melbourne (IUNS) were exceeding the recommended range (non-discretionary only), compared with Melbourne Greeks (<8%).

ii) Potassium

Potassium intake below 1117mg leads to potassium depletion as measured by an abnormally low serum level, while daily intakes below 1875mg are likely to cause problems in some elderly people. Many investigators have taken 2350-2540mg per day as the lowest safe level of intake (Judge and Cowan, 1971).

Results: A greater proportion of Spata elderly had intakes below 1875mg (M 15%, F 45%) compared with Melbourne elderly (M 2%, F 11%). Similarly, 62% of Spata women had intakes below 2350mg compared with 47% of Spata men, 30% of Melbourne women and 11% of Melbourne men (see table 10.3.14d).

Comparisons with reported data: Evidence suggests that a reasonable proportion of the elderly population in developed countries, particularly females, are consuming potassium in amounts below the lower safe level of intake. Steen et al., (1977) reported that 10% of men had potassium intakes below 2030mg and 10% of women had intakes below 1800mg. In Australia, less than 10% had intakes below 1950mg (Baghurst and Record, 1987; Horwath, 1987; Wahlqvist et al., in press). Intakes were below 1560mg in 9% of men and 14% of women studied by MacLeod et al., (1975) and were below 2350mg in 38-65% of men and 60-85% of women in three other surveys (Judge and Cowan, 1971; Borgstrom et al., 1979; Davies, 1981).

iii. Calcium

Results: About 20% of the men and 35% of the women were found to have calcium intakes below two thirds of the RDI (see Table 10.3.14e). The majority of elderly Greeks did not meet the recommended calcium density (70% of men, 87% women).

Comparisons with reported data: In the Euronut study, 11% of the Greek men did not meet the lowest European RDI compared with 4% of the Markopoulo women and 47% of the Cretan women. In the National Dietary Survey in Australia, 45% of the Southern European men and women had intakes below two thirds of the Australian RDI, compared with only 17% of elderly Greek men and 28% of the women. Similar proportions of Anglo-Celtic elderly in Melbourne and Adelaide had values below two thirds of the Australian RDI (M 11-14%, F 20-30%). In Horwath's review (1989a) of elderly dietary studies, *for the **women*** mean dietary calcium intakes were above 800mg in only 5 studies (including the Australian studies); mean intakes between 700-800mg were reported in 14 studies (e.g DHSS); between 600-700mg in seven studies; between 500-600mg in 12 studies (eg NFCS) and below 500mg in five studies (e.g NHANES). Mean dietary calcium intakes were generally higher in **men** - mean intakes were estimated to be above 800mg in 19 studies (e.g DHSS), including the Australian studies; between 700-800mg in eight studies (e.g NFCS); between 600-700mg in five studies; below 600mg/day in ten studies (e.g NHANES). Horwath (1989a) concludes that *'an examination of mean intakes raises doubts as to the adequacy of calcium intake in elderly women'.*

iv. Phosphorus

Phosphorus deficiency is rare. It is found in most foods containing protein and/or calcium. It has not been reported to be inadequately consumed by elderly people (Horwath, 1989a).

Results: Less than 3% of Melbourne elderly were found to have phosphorus intakes below two thirds of the RDI, compared with <5% of Spata men and 16% of Spata women (aged 70-79). The majority of the subjects met the recommended phosphorus density (see Table 10.3.14e).

Comparisons with reported data: Anglo-Celtic elderly in Melbourne and Adelaide did not have values below two thirds of the Australian RDI.

v. Magnesium

Results: More than half of the Spata elderly (57%) did not achieve two thirds of the RDI for magnesium, compared with only 19% of Melbourne elderly. The majority of elderly Greeks did not meet the recommended magnesium density (90% of men, 96% of women) (see table 10.3.14e).

Comparisons with reported data: In the National Dietary Survey in Australia, 23% of the Southern European men and 34% of the women had intakes below two thirds of the Australian RDI, compared with 15% of Melbourne Greek men and 22% of women. In the Anglo-Celtic studies in Melbourne and Adelaide, only 12-13% of the men and 5-8% of the women had values below two thirds of the Australian RDI. In the Nationwide Food Consumption Survey in America (1980) about 40% of men and 45% of women had magnesium intakes below 245 and 210mg, respectively. In the Swedish study in which the magnesium content of the diets was chemically analysed, about one third of men and two thirds of women consumed diets containing less than 200mg (Borgstrom et al., 1979).

vi. Iron

Results: Less than 5% of the Greek men and <10% of the women had iron intakes below two thirds of the RDI. The majority of the subjects met the recommended iron density (see table 10.3.14e).

Comparisons with reported data: In the Euronut study, less than 12% of the Greek elderly had iron intakes below two thirds of the lowest European RDI (except Cretan women 58%). In the National Dietary Survey in Australia, 3% of Southern European men and 49% of the women had intakes below two thirds of the Australian RDI, compared with <10% of elderly Greeks in Melbourne. Less than 5% of the Anglo-Celtic elderly in Melbourne and Adelaide had intakes below two thirds of the Australian RDI.

vii. Zinc

Results: In Spata a significantly greater proportion of elderly were not meeting two thirds of the RDI (M 11%, 32%) compared with Melbourne (M 5%, F 21%). The majority of elderly Greeks did not meet the recommended zinc density (51% of men, 75% women) (see Table 10.3.14e).

Comparisons with reported data: In the National Dietary Survey in Australia, 40% of the Southern European men and 50% of the women had zinc intakes below two thirds of the Australian RDI, compared with <10% of elderly Greek men and <35% of women. A greater proportion of Anglo-Celtic elderly men in Melbourne (M 23%, F 32%) were not reaching two thirds of the RDI for zinc compared with Melbourne Greek men. The proportion of elderly Anglo-Celtics in Adelaide not achieving two thirds of the RDI was markedly greater (M 57%, F 68%) than Melbourne Anglo-Celtic. In a random sample of 65-75 year old South Australians, 45% of men and 66% of women had zinc intakes below 12mg (Baghurst and Record, 1987).

Twenty to 35% of men and 47-55% of women consumed less than 7.5mg of zinc in two studies (Borgstrom et al., 1979; Garry et al., 1982a,b). While 53% of subjects had intakes below 5mg in one large random American study (Morgan and Zabik, 1984). In another four studies, intakes below 10mg were found in 35-60% of men and in 64-69% of women (Forsmire et al., 1984; McGandy et al., 1986); in 21% of subjects (Flint et al.,1981) and in 59% of subjects (Greger and Sciscoe,1977).

B. VITAMINS

The percentage of subjects below two thirds of the RDIs and RNDs for vitamins are shown in table 10.3.14f.

Table 10.3.14f

The % below two thirds of the US RDIs for vitamins (% below RNDs)

	SPATA		MELBOURNE	
	70-79 <0.7 RDI (<RND)	80+ <0.7 RDI (<RND)	70-79 <0.7 RDI (<RND)	80+ <0.7 RDI (<RND)
MEN				
N	32	19	66	28
Vitamin A (µg RE)*	53.2 (61)	57.9 (79)	25.8 (74)	17.9 (68)
Thiamin (mg)	31.3 (97)	78.9 (100)	6.1 (71)	14.3 (75)
Riboflavin (mg)	12.5 (75)	5.3 (68)	3.0 (38)	0.0 (28)
Niacin (mg NE)**	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Vitamin C (mg)	6.2 (25)	5.3 (37)	0.0 (3)	0.0 (0)
WOMEN				
N	31	22	59	36
Vitamin A (µg RE)*	67.7 (87)	54.5 (86)	15.3 (10)	25.0 (66)
Thiamin (mg)	48.4 (100)	68.2 (98)	10.2 (35)	16.7 (86)
Riboflavin (mg)	22.6 (87)	9.1 (64)	3.4 (52)	11.1 (47)
Niacin (mg NE)**	0.0 (0)	0.0 (0)	0.0 (0)	0.0 (0)
Vitamin C (mg)	16.1 (35)	18.2 (41)	1.7 (5)	0.0 (8)

Vitamin A (µg Retinol equivalents) = retinol µg + carotene µg/6; Niacin (mg Niacin equivalents) = niacin mg + (0.16 x protein g)*

i. Vitamin A

Results: A greater proportion of Spata elderly did not achieve two thirds of the RDI (58%) compared with only 20% of Melbourne elderly (see Table 10.3.14f). The majority of Greek elderly did not meet the recommended vitamin A density (M 70%, F 62%).

Comparisons with reported data: A similarly high proportion of Greek elderly in the Euronut study were consuming less than two thirds of the European RDI (M 32%, F 44%). A greater proportion of Southern European Australians in the National Dietary Survey were not achieving two thirds of the Australian RDI (M 46%, F 39%) compared with elderly Greeks in Melbourne (20%). Only 14% of Anglo-Celtic elderly men and 2% of women in Melbourne had intakes below two thirds of the RDI. Similarly, less than 3% of Anglo-Celtic elderly in Adelaide had intakes below two thirds of the RDI.

ii. Thiamin

Results: A significantly greater proportion of Spata men and women (56%) were not achieving two thirds of the RDI, compared with less than 13% of Melbourne elderly (see Table 10.3.14f). In Spata, almost all subjects did not meet the recommended thiamin density compared with less than 70% of Melbourne elderly.

Comparisons with reported data: A smaller proportion of Cretan elderly in the Euronut study were consuming less than two thirds of the European RDI (M 10%, F 31%) compared with Spata elderly (M 55%, F 58%). In the National Dietary Survey a greater proportion of Southern European Australians were not achieving two thirds of the Australian RDI (M 34%, F 32%) compared with elderly Greeks in Melbourne (M 10%, F 13%). Only Anglo-Celtic men in Melbourne (7%) were found to have intakes below two thirds of the RDI. Less than 3% of Adelaide elderly had intakes below two thirds of the RDI.

iii. Riboflavin

Results: A greater proportion of Spata elderly were not achieving two thirds of the RDI (M 9%, F 16%) for riboflavin compared with Melbourne elderly (M 1%, F 7%). About 70% of Spata elderly did not meet the recommended riboflavin density compared with less than 50% of the Melbourne elderly (see Table 10.3.14f).

Comparisons with reported data: A significantly greater proportion of Cretan elderly in the Euronut study had intakes below two thirds of the lowest European RDI (M 29%, F 56%) compared with Spata elderly (M 9%, F 16%). A greater proportion of Southern European Australians were not achieving two thirds of the Australian RDI (M 37%, F 31%) compared with elderly Greeks in Melbourne (M 1%, F 7%). Less than 2% of Anglo-Celtic elderly in Melbourne and Adelaide were found to have intakes below two thirds of the RDI. NHANES I found that 12% to 36% of the elderly had riboflavin intakes below two thirds of the RDI and according to biochemical measures, up to 28% of the elderly were deficient in riboflavin.

iii. Niacin

Results: All the elderly were found to achieve two thirds of the RDI for niacin and the recommended niacin density (see Table 10.3.14f).

Comparisons with reported data: A greater proportion of Southern Europeans were not achieving two thirds of the Australian RDI for niacin (M 3.8%, F 1.7%) compared with elderly Greeks (0%). All the Anglo-Celtics in Melbourne and Adelaide achieved two thirds of the RDI. In the majority of studies, niacin has not been found to be inadequately consumed by elderly people (Horwath, 1989a).

iv. Vitamin C

Results: A greater proportion of Spata elderly (M 6%, F 17%) were not achieving two thirds of the RDI for vitamin C compared with Melbourne elderly (F 2%, M 0%). About 35% of the Spata elderly were not achieving the recommended vitamin C density compared with less than 10% of the Melbourne Greeks (see Table 10.3.14f).

Comparisons with reported data: A smaller proportion of Cretan elderly were consuming less than two thirds of the lowest European RDI (M 0%, F 9%) compared with Spata elderly (M 6%, F 17%). A greater proportion of Southern European Australians were not achieving two thirds of the Australian RDI (M 23%, F 11%) compared with elderly Melbourne Greeks (M 0%, F 2%). Less than 4% of Anglo-Celtic elderly in Melbourne and Adelaide were found to have intakes below two thirds of the RDI

10.4 DISCUSSION

The evidence is now undisputed that food and nutrient intake are directly linked to many of the chronic diseases afflicting older adults and the elderly (Blumberg, 1992). Numerous factors have been linked with malnutrition in the elderly such as reduced energy needs, presence of chronic diseases, sociopsychological factors such as loneliness, social networks and social activity, economic factors and education. This reminds us that we cannot think about nutrients without thinking about food and without thinking about the circumstances under which people eat (see also chapters 6 & 9).

An adequate nutrient intake will ultimately depend upon obtaining an adequate energy intake. There appears to be a high percentage of elderly (about 50%) with low energy intakes, especially women. This was observed in the current study and in numerous other studies (Fidanza and Alberti, 1974; Werner and Berfenstam, 1974; HANES Lonergan et al., 1975; NCS: Kohrs et al., 1978; Fidanza and Losito, 1981; Garry et al., 1982a,b; Havlir et al., 1983; Horwath, 1987). Nevertheless, there is still a high prevalence of obesity among elderly subjects, particularly in women (see Chapter 11).

It appears that actual energy intakes may be too high in relation to the activity levels of elderly people. Decreased levels of energy expenditure with increasing age have been reported in several studies (Durnin, 1966, 1967, 1969; Durnin and Passmore, 1967; Cunningham et al., 1968; 1969; Clarke, 1974) and are probably a major contributor to the problem of obesity in the elderly. The food intake required to balance an increased energy expenditure is generally accompanied by a poor appetite and low food intake, and may therefore be the origin of many of the nutritional problems of the elderly (Horwath, 1989a).

Energy intakes were similar in elderly Melbourne and Spata Greeks. Other studies on elderly Greeks in Greece (de Groot et al., 1991; Trichopoulou et al., 1993) and Anglo-Celtic Australians (Wahlqvist et al., in press) have also reported similar energy intakes. Upon migration, anecdotal evidence suggests that energy intakes probably increased markedly in the first 10 years and subsequently decreased in the aged to pre migration levels (Webb and Manderson, 1990).

Even though energy intakes were similar between centres, the proportion of energy intake from macronutrients was significantly different. Greek diets in Greece are characterised by low-moderate protein intake (15%), high complex carbohydrate intake (28%), low simple/refined carbohydrate intake (14%) but low overall total carbohydrate intake (37-44%) (Trichopoulou et al., 1993a,b). In the current study, almost identical values were obtained except that Greeks in Melbourne appear to have decreased complex carbohydrates (mainly from bread, pasta, potatoes) and increased simple/refined carbohydrates (mainly from fruit juice), protein (mainly from meat) and polyunsaturated fat intakes (mainly from margarine) to levels found in Anglo-Celtic Australians (Wahlqvist et al., in press; Horwath, 1987; Baghurst and Record, 1987) (see also chapter 9).

Studies comparing migrants with their country of origin are limited and where available nutrient intakes are not reported (Powles et al., 1988). The significance of these nutrient changes upon migration and subsequent impact on health requires further investigation. To date there has been no conclusive evidence that separated sugars are an independent risk factor for heart disease, cancer, obesity or diabetes in the general population. In contrast, complex carbohydrates have been implicated as protective against these diseases (US National Research Council, 1989). There is a need for more long-term population studies and intervention trials with healthy subjects consuming different types of complex carbohydrates (e.g low or high glycaemic index) with respect to onset of chronic diseases. For example, equivalent reductions of serum LDLcholesterol can be achieved by substituting saturated fats with either more carbohydrate (e.g Asian diet) or by more monounsaturated fats (e.g Mediterranean diet) (Wahlqvist & Kouris-Blazos, 1991).

Free-living healthy elderly people have often been stereotyped as being protein deficient, surviving on tea and toast. The more than adequate protein intake of elderly Greeks (especially in Melbourne) is consistent with other studies (de Groot et al., 1991; Horwath, 1989). Clinical signs of protein deficiency have been shown to occur in only 3% of the elderly population (DHSS, 1972; HANES), and in most cases as a consequence of physical or mental disorder. The question is probably more of protein excess rather than deficiency and its potentially harmful effects to health. The currently high protein intake of Australians (including migrants) has not been shown to be a risk factor for heart disease but there is some uncertainty regarding the effect of animal proteins on tumorigenesis (Ireland and Giles, 1993). National authorities are now inclined to recommend increased consumption of plant proteins which have been associated with reduced rates of heart disease and colonic cancer (US National Research Council, 1989; Wahlqvist and Kouris-Blazos, 1991).

The high intake of fat by elderly Greeks (42% energy intake) is also in agreement with other studies done in Greece (de Groot et al., 1991; Trichopoulou et al., 1993a, 1993b). Total fat intake does not appear to have changed upon migration but the proportions of fatty acids have changed towards a greater intake of polyunsaturates similar to levels found in Anglo-Celtic Australians. Case control studies from Greece have not been able to show adverse effects of the currently high fat intake (40-45%) of most Greeks to either cancer risks, coronary heart disease or obesity. Researchers in Greece argue that the current evidence does not justify the reduction in fat intake in the Greek diet if derived mainly from monounsaturated fats (Trichopoulou, 1991; Trichopoulou et al., 1993a).

Greek diets are characterised by a high fat intake (40%), a high monounsaturated fat intake (20%), low saturated fat intake (12%) and low polyunsaturated fat intake (3%-5%) (Trichopoulou et al., 1993a). Almost identical fat proportions were obtained in the current study except that Melbourne Greeks obtained 6-7% of energy intake from polyunsaturates. The majority of the polyunsaturated fat in the Spata diet originated from olive oil where as in Melbourne it was also obtained from margarine and other vegetable oils. There is rising concern regarding high polyunsaturated fat intakes and tumorigenesis, diabetes and prooxidant activity producing the more atherogenic oxidised cholesterol (US National Research Council, 1989; Wahlqvist and Kouris-Blazos, 1991).

The higher intake of polyunsaturates and protein and lower intake of complex carbohydrates on migration may be contributing to the rising prevalence of heart disease and cancer in Greek Australians to the higher levels found in Anglo-Celtic Australians (see Appendix 1 - Australian Bureau of Statistics National Health Survey, 1989-90 and Chapter 2).

Many population studies from different parts of the world have shown that free-living elderly people have a relatively good nutrient intake (Horwath, 1989a; Horwath et al., 1992; Steen, 1977; Rasanen et al., 1992; Lowik et al., 1989) and that the ageing process per se is not a cause of malnutrition in healthy elderly (Vellas et al., 1992; Lundgren et al., 1987; Sjogren et al., 1993). The insufficient vitamin status of very old multimorbid patients on multiple medications is more a result of accompanying sickness than of old age per se (Heseker and Kubler, 1992). The most frequently described exception is vitamin A as result of increased absorption and decreased clearance and vitamin C and B12 for men (Suter and Russell, 1987).

Nutritional status surveys of the elderly have shown a low to moderate prevalence of frank nutrient deficiencies but a marked increase in *risk* of malnutrition and evidence of subclinical nutrient deficiencies (Blumberg, 1992). The published studies suggest that calcium, zinc, potassium, magnesium, thiamin, riboflavin, vitamin B6 and folate are likely to be the nutrients least adequately supplied in the diets of elderly people and that sodium intake is above recommended levels (Horwath, 1989a; de Groot et al., 1991). RDIs are intended to be neither minimal requirements nor necessarily optimal levels of intake. If nutrient allowances are to provide for optimal health then some 'nonclassical' functions of the micronutrients (e.g antioxidant activity) and their potential for preventing chronic diseases may need to be taken into account (Blumberg, 1992).

Although evidence strongly implicates sodium in the development of hypertension (US National Research Council, 1989), sodium intakes have not been routinely reported in dietary studies of elderly people. National bodies recommend a salt intake of between 3-8g per day, which is achieved easily without adding salt to cooking or at the table (Horwath, 1989a). The sodium intakes (non-discretionary only) of elderly Greeks were well within the recommended range. In contrast, a large proportion of Anglo-Celtic Australians (40%) exceeded the recommended without including the salt added to food. It appears that the sodium in the food supply itself (naturally occurring or added in commercial food production) already equals or exceeds the recommended range for dietary sodium. Elderly Greeks are possibly eating less commercially processed foods compared with Anglo-Celtic Australians.

A permanent state of hypokalaemia arising from long-standing negative potassium balance, can produce muscle weakness, apathy, muscle paralysis, impaired cardiac function, constipation, confusion, depression and anorexia. Therefore, a number of problems which have often been associated with physiological ageing, may be partly due to a dietary deficiency of potassium (Judge and Cowan, 1971). The extensive use of drugs which influence potassium balance (e.g diuretics, laxatives, corticosteroids, insulin) combined with the problem of inadequate intake makes potassium depletion relatively common among the elderly (Judge and Cowan, 1971). In the current study, inadequate potassium intake appeared more prevalent in Spata (especially the women) than in Melbourne elderly. Interestingly, Spata women were also more likely to report a poorer sense of well-being and self-rated health status compared with Melbourne women. Anglo-Celtic Australians have been reported to have higher potassium intakes than Melbourne Greeks - these differences being particularly marked for the women. The high potassium intakes are associated with the high vegetable, meat and milk intakes of Melbourne Greeks and Anglo-Celtics compared with Spata (see chapter 9).

The combination of a low-sodium, high-potassium intake is associated with the lowest blood pressure levels and the lowest frequency of stroke in individuals and populations (US National Research Council, 1989). The low sodium and higher potassium intake of Melbourne Greeks suggests that they may be at reduced risk of stroke compared with Greeks in Greece. This is supported by mortality data whereby Greek Australians have been reported to have lower stroke rates than Anglo-Celtic Australians and Greeks in Greece (Young, 1986; World Health Organization, 1992; ABS 1991).

Higher levels of calcium intake have been correlated with slower bone loss and better bone mass, delaying the onset of osteoporosis. Osteoporosis constitutes a major health cost to our health care system. About half of all women can expect to have an osteoporotic bone fracture as they get older (especially hip and wrist fractures) and spinal compression (US National Research Council, 1989; Kouris-Blazos, 1991a). About one third of Greek elderly (mainly women) had calcium intakes below two thirds of the US RDI. Melbourne elderly appeared to be increasing their calcium intakes to the higher levels found in Anglo-Celtic Australians, mainly due to greater intakes of milk. These results suggest that Greek elderly in Spata may be at higher risk of osteoporosis than Melbourne elderly.

The dietary magnesium intake of elderly subjects is of interest because of its metabolic relationship to other elements such as calcium and potassium, as well as its possible significance in cerebrovascular disease and hypertension (US National Research

Council, 1989). Although there is very little data on the magnesium intakes of elderly populations, the available studies suggest that intakes may well be below optimum levels (MacLeod et al., 1975; NFCS: Borgstrom et al., 1979; Vir and Love, 1979; Morgan and Zabik, 1984; Baghurst and Record, 1987; Horwath, 1987). Magnesium intake was greater in Melbourne elderly, mainly due to their greater intake of vegetables, legumes, and wholegrain cereals (see chapter 9). More than 50% of the Spata elderly were not achieving two thirds of the RDI compared with less than 20% of the Melbourne elderly. This raises questions about the contribution of inadequate magnesium intake to the higher stroke rates in elderly Greeks in Greece (WHO, 1992).

Dietary inadequacy of iron is seldom responsible for the development of iron-deficiency anaemia (McLennan et al., 1973; Kohrs et al., 1978; Vir and Love, 1979; Bailey, 1986). Other factors such as blood loss, drug therapy, disease and neoplasm are the principal causes of iron-deficiency anaemia in this age group (McLennan et al., 1973). There have been few random surveys (using methods other than the 24-hour recall) which reported low iron intakes in more than 30% of subjects (Lonergan et al., 1975; Borgstrom et al., 1979; DHSS, 1979). Similarly in the current study, less than 10% of the Greek elderly had iron intakes below two thirds of the RDI.

Recently, there has been an interest in excessive intake of iron rather than inadequate intake. High levels of dietary intake and subsequently storage iron have been associated with heart disease, colon and stomach cancer, impaired immunity, ageing and inflammatory disease (Salonen et al, 1992; Stadtman, 1992). It has been suggested that high levels of iron in the diet and body stores may play a role as a pro-oxidant, enhancing free radical production, which damages cellular function. Elderly Greeks were found to have markedly higher iron intakes than Anglo-Celtic Australians (Wahlqvist et al., in press, Horwath, 1987; Baghurst and Record, 1987). Furthermore, Melbourne elderly were found to have significantly higher iron stores than Spata elderly, approaching the higher levels found in Anglo-Celtic Australians (see Chapter 11). It appears that Melbourne Greeks may have had the high iron intakes over a longer period of time in order to allow the stores to increase to such levels. A contributing factor was probably the increased consumption of meat upon migration in the 1960s and maintenance of such intakes till the 1990s (see chapters 8 and 9). This raises questions about the importance of such high iron intakes and stores on the rising prevalence of heart disease in Melbourne Greeks (ABS, 1991).

Dietary zinc intake in the elderly is an important issue in view of the apparent contribution of deficient zinc nutriture to poor wound healing, impaired immune response, hypogeusia, night-blindness and decreased smell acuity (Sandstead et al., 1982). Energy intake is an important factor affecting zinc nutriture (Holden et al., 1979). In the current study, more than 30% of the women were not achieving two thirds of the RDI compared with less than 10% of the men. This is probably related to the large percentage of women not achieving the recommended energy intake (1600kcal/day).

Overall, Greeks in Melbourne had diets of higher mineral density than Spata elderly, particularly for potassium, phosphorus, magnesium, and zinc. However, the diets of elderly Greeks did not meet the recommended nutrient densities for calcium (70% of men, 87% women), magnesium (90% of men, 96% of women), and zinc (51% of men, 75% women). Calcium intakes in the Euronut study (de Groot et al., 1991) also failed to achieve the RND for most centres, including the Greek centres. Phosphorus, iron and potassium were least likely to be inadequately consumed (except Spata women). The mineral densities of the men and women were not significantly different.

It is clear from the standard deviations of the mean intakes, that certain vitamins are ingested much more variably within and between populations than are others. Vitamin A intakes are particularly variable, which may mean either that vitamin A homeostasis can be achieved despite wide variation in intake, or that a wide range of intakes may have implications for a wide range of functional outcomes. Which of these interpretations is correct depends on greater knowledge of vitamin A physiology and pathophysiology in elderly people (Wahlqvist and Flint-Richter, 1989). Surveys have shown that a considerable proportion of elderly receive less than the US RDI for vitamin A, but this is not reflected in plasma retinol levels. About half of the elderly surveyed in NHANES I had vitamin A intakes less than two thirds of the RDI, but less than 1% had plasma retinol levels below the critical 0.7µmol/l.

Similarly in the current study, 60% of Spata elderly and 20% of Melbourne elderly did not achieve two thirds of the RDI. In the Euronut study, more than 30% of the elderly Greek subjects were not achieving the European RDI (de Groot et al., 1991). Evidence indicates that the elderly can maintain adequate body stores of vitamin A at intakes that are lower than the RDI. There is no evidence of vitamin A insufficiency in elderly populations (Ahmed, 1992; Horwath, 1989a). Nevertheless, vitamin A is still of particular interest because of its antioxidant properties (mainly carotene) and its protective effect against cardiovascular diseases and cancer (US National Research Council, 1989). In this respect Melbourne Greeks may be at an advantage due to their significantly higher intakes of this vitamin (mainly from carotene) compared with Spata elderly.

Low intake of thiamin in the elderly appears to be secondary to social factors or chronic illness. Age-related changes in thiamin metabolism have not been reported (Ahmed, 1992). Inadequate thiamin intake can contribute to poor appetite, fatigue, difficulty walking, polyneuropathy, hypertension, oedema and cardiac failure (Davidson et al., 1979). Surveys show that up to 47% of the US elderly have thiamin intakes below two thirds of the RDI compared with less than 10% of Anglo-Celtic Australians (Horwath, 1989a). In the current study, more than 50% of the Spata elderly were not achieving two thirds of the RDI compared with less than 10% of Melbourne Greeks. This is mainly due to their lower intakes of wholegrain cereals & breakfast cereals and meat. Other studies from Greece have shown slightly higher intakes of thiamin with 10-30% of elderly subjects not achieving two thirds of the RDI (de Groot et al., 1991). The low thiamin intakes of elderly Greeks in Spata (especially women) and contribution to symptoms of deficiency, requires further investigation. Interestingly, Spata women were more likely to report poor sense of well-being and self-rated health compared with Melbourne women.

There is no definitive evidence for changes in riboflavin absorption by human beings because of aging, and no notable age-related changes in riboflavin tissue levels. Minor signs of deficiency (e.g stomatitis) occur after a prolonged period of low intake. Why these conditions do not progress and lead to serious illness remains a mystery (Davidson et al., 1979). In the majority of studies, riboflavin has not been found to be inadequately consumed by elderly people (Horwath, 1989a). In the current study, Melbourne elderly had significantly higher values with less than 4% having intakes below two thirds of the US RDI compared with 12% of Spata elderly. This is mainly due to the greater consumption of milk in Melbourne Greeks.

Studies such as NHANES I and the Ten State study have shown a range of intakes below the current US RDI for vitamin C, yet scurvy is rarely seen except in alcoholics and impoverished elderly men who do not eat fruits and vegetables (Ahmed, 1992). Factors such as smoking, medications, emotions and stress also have a negative effect on vitamin C nutriture (Gary and Hunt, 1986). Although vitamin C has not been reported to be inadequately consumed by most elderly people (Horwath, 1989a), it is of particular interest because of its combined antioxidant and prooxidant properties at high intakes (US National Research Council; Herbert 1993). Sex specific differences in tubular reabsorption of ascorbic acid in the kidney results in higher mean plasma values for women than for men. Therefore women have a significant physiological advantage in the supply of this antioxidant (Heseker and Kubler, 1992). Melbourne Greeks were consuming almost twice as much vitamin C compared with Spata Greeks, approaching the higher levels found in Anglo-Celtic Australians. Melbourne Greeks had significantly greater intakes of citrus fruits and fruit juices than Spata elderly (see chapter 9). The effect of high vitamin C intakes on heart disease and cancer prevalences in elderly Greeks in Melbourne, requires further investigation. Overall, Greeks in Melbourne had diets of higher vitamin density than Spata elderly, particularly for vitamin A, carotene, thiamin, riboflavin, niacin, and vitamin C. The diets of elderly Greeks did not meet the recommended vitamin densities for thiamin (80% of men, 90% women), riboflavin (70% of men, 63% of women), and vitamin A (80% of men, 75% women). However, Melbourne women aged 70-79, achieved the RND for vitamin A and thiamin. Vitamin A, thiamin and riboflavin densities in the Euronut study (de Groot et al., 1991) also failed to achieve the RND for most centres, including the Greek centres. Vitamin C and niacin were least likely to be inadequately consumed (especially in Melbourne). Spata elderly appear to be at risk of vitamin deficiency, particularly for thiamin. A significant proportion of elderly Greeks were not meeting the RDIs for certain nutrients. This raises the question whether or not the RDI or the intake needs to be adjusted. In the final analysis, the critical question as far as RDIs are concerned is how an intake relates to function.

10.5 SUMMARY

Average energy intake in Spata (M 2200kcal/day, F 1700 kcal/day) was not significantly different to mean energy intakes in Melbourne elderly (M 2350kcal/day, F 1850kcal/day). The men had a higher energy intake than the women, but intake did not decrease with age. Anglo-Celtic elderly in Melbourne have also been reported to have similar energy intakes (M 2400, F 2070). Only 30% of the Greek men had intakes below the recommended 2000kcal/day. Significantly more Spata women had intakes below 1600kcal (45%) compared with Melbourne women (21%). Only 2% of Melbourne women had intakes below 1200kcal compared with 15% of Spata women.

Spata elderly consumed significantly more energy from total carbohydrates (39%) compared with Melbourne elderly (37%). Furthermore, a greater proportion of total carbohydrates were obtained from complex/unrefined sources in Spata (27% energy intake) compared with Melbourne elderly (23% energy intake). Gender and age group differences were not seen within centres. Melbourne men consumed more energy from refined carbohydrates (14%) compared with Spata men (12%). Anglo-Celtic elderly Australians consume slightly less complex carbohydrate (22%) but significantly more simple carbohydrates (21%) than Melbourne Greeks.

Percentage energy intake from protein was significantly greater in Melbourne elderly (19%) than Spata elderly (16%), approaching the higher levels found in Anglo-Celtic Australians (19%). Percentage energy intake from fat (42%) was similarly high in Spata and Melbourne. It appears that upon migration fat intake has not dropped to the lower levels found in Anglo-Celtic Australians (35%-38%). Percentage energy intake from saturated fat (12%) was similarly low in Spata and Melbourne compared with Anglo-Celtic Australians (15%).

Percentage energy intake from monounsaturated fat was high in Spata (22%) and Melbourne (21%) compared with Anglo-Celtic Australians (11%). Spata women aged 70-79 obtained a greater proportion of their total energy from monounsaturated fat compared with Melbourne women. Percentage energy intake from polyunsaturated fat was significantly greater in Melbourne Greeks (6%) compared with Spata elderly (5%), approaching higher levels found in Anglo-Celtic Australians (6-7%). The P+M/S ratio was 2.2 in both Spata and Melbourne, which is significantly lower than the mean ratio of Anglo-Celtic Australians (1.3). Mean cholesterol intake was significantly greater in Melbourne (320g/day) compared with Spata (240g/day), approaching the higher levels found in Anglo-Celtic Australians (340g/day).

Percentage of energy intake from alcohol was similar in both Spata (M 5%, F 1%) and Melbourne (M 3%, F 1%). However, significantly more Spata women never consumed alcohol (83%) compared with Melbourne women (50%). Similar proportions of men never consumed alcohol (34%). Alcohol intake of elderly Anglo-Celtic Australians (M 4%, F 2%) is similar to Melbourne Greeks.

Melbourne elderly consumed significantly more fibre (M 28g/day F 22g/day) than Spata elderly (M 20g/day, F 16g/day), approaching the higher levels found in elderly Anglo-Celtic Australians (M 28g/day, F 30g/day). Less than 10% of Spata elderly had fibre intakes above 30g/day, compared with 30% of Melbourne elderly.

Water intake (includes all beverages and water in foods) was significantly greater in Spata men aged 70-79 (2800g/day) compared with Melbourne men (2400g/day). The women had similar mean intakes (1800g/day). Anglo-Celtic men and women had mean intakes of about 2500g/day. About 15% of the Greek women had very low water intakes (<1200ml/day) which may put them at risk of dehydration.

Mean sodium intakes (non-discretionary only) were similarly low for both men (2200mg) and women (1700mg) in Spata and Melbourne. However, Melbourne Greeks appeared to have higher sodium intakes than Spata elderly, especially the women aged 70-79. Compared to elderly Anglo-Celtic Australians, (non-discretionary only M 3274mg, F 2950mg) Greeks had significantly lower sodium intakes with less than 8% exceeding the recommended range. A large proportion of Anglo-Celtic elderly (40%) were already exceeding the recommended, without adding salt to their food.

Melbourne elderly had significantly greater potassium intakes (M 3500mg/day, F 2700mg/day) than Spata elderly (M 2500mg/day, F 2000mg/day), approaching the higher levels found in elderly Anglo-Celtic Australians (M 3740mg/day, F 3690mg/day). Spata women in particular (45%) were found to have very low potassium intakes (<1875mg/day).

Mean calcium intakes were similarly low in Spata (M 686mg/day, F 580mg/day) and Melbourne (M 840mg/day, F 652mg/day). However, there appeared to be a trend for Melbourne Greeks to be increasing their intakes to the higher levels found in Anglo-Celtic Australians (M 855mg/day, F 905mg/day). About 20% of the Greek men and 35% of the women were found to have values below two thirds of the RDI.

Mean phosphorus intakes were significantly greater in Melbourne (M 1512mg/day, F 1185mg/day) than Spata (M 1142mg/day, F 940mg/day), approaching the higher levels found in elderly Anglo-Celtic Australians (M 1589mg/day, F 1598mg/day). Less than 5% of elderly had intakes below two thirds of the RDI, except Spata women (16%).

Mean magnesium intakes were significantly greater in Melbourne (M 330mg/day, F 256mg/day) than Spata (M 230mg/day, F 181mg/day), approaching the higher levels found in elderly Anglo-Celtic Australians (M 346mg/day, F 354mg/day). More than half of the Spata elderly (57%) did not achieve two thirds of the RDI, compared with only 19% of Melbourne elderly.

Spata and Melbourne elderly had similarly high iron intakes (M 20mg/day, F 18mg/day, M 23mg/day, 20mg/day respectively), which were significantly greater than intakes found in elderly Anglo-Celtic Australians (M 14mg/day, F 14.5mg/day). Less than 5% of the Greek men and <10% of the women had iron intakes below two thirds of the RDI.

Melbourne elderly had significantly greater mean zinc intakes (M 18mg/day, F 15mg/day) than Spata elderly (M 15mg/day, F 12mg/day), which were also significantly greater than intakes found in elderly Anglo-Celtic Australians (M 14mg/day, F 13mg/day). In Spata, a greater proportion of elderly were not meeting two thirds of the RDI (M 11%, 32%) compared with Melbourne (M 5%, F 21%).

Overall, Greeks in Melbourne had diets of higher mineral density than Spata elderly, particularly for potassium, phosphorus, magnesium, and zinc. However, the diets of elderly Greeks did not meet the recommended nutrient densities for calcium (70% of men, 87% women), magnesium (90% of men, 96% of women), and zinc (51% of men, 75% women). Phosphorus, iron and potassium were least likely to be inadequately consumed (except Spata women). The mineral densities of the diets for both men and women were similar within centres.

Melbourne elderly (M 1030 RE/day, F 883 RE/day) had a greater vitamin A intake than Spata elderly (M 727 RE/day, F 505 RE/day), approaching the higher levels found in Anglo-Celtic Australians (M 1200 RE/day, F 1114 RE/day). Significantly more Spata elderly did not achieve two thirds of the RDI (58%) compared with Melbourne elderly (20%). Melbourne women had a higher vitamin A density than the men.

Melbourne elderly (M 3947 µg/day, F 3200 µg/day) had a greater mean carotene intake than Spata elderly (M 1907µg/day, F 1503 µg/day), approaching the higher levels found in Anglo-Celtic Australians (M 4500 µg/day, F 4373 µg/day). Retinol intakes were similar in Spata and Melbourne Greeks and in Anglo-Celtic Australians (M 400µg/day, F 330µg/day).

Melbourne elderly (M 1.3 mg/day, F 1 mg/day) had a greater mean thiamin intake than Spata elderly (M 0.8 mg/day, F 0.7 mg/day), approaching the higher levels found in Anglo-Celtic Australians (M 2.32 mg/day, F 2.0 mg/day). A significantly greater proportion of Spata men and women (56%) were not achieving two thirds of the RDI, compared with Melbourne elderly (13%). Melbourne elderly (M 1.8mg/day, F 1.4mg/day) had a higher riboflavin intake than Spata elderly (M 1.3mg/day, F 1.0mg/day), approaching the higher levels found in Anglo-Celtic Australians (M 3.1 mg/day, F 2.9 mg/day). A greater proportion of Spata elderly were not achieving two thirds of the RDI (M 9%, F 16%) compared with Melbourne elderly (M 1%, F 7%).

Melbourne elderly (M 42mg/day, F 32mg/day) had a higher niacin intake than Spata elderly (M 30mg/day, F 23mg/day), approaching the higher levels found in Anglo-Celtic Australians (M 49 mg/day, F 44 mg/day). All the elderly were found to achieve two thirds of the RDI. Melbourne elderly (M 161mg/day, F 135mg/day) had a higher vitamin C intake than Spata elderly (M 80mg/day, F 70mg/day), approaching the higher levels found in Anglo-Celtic Australians (M 170 mg/day, F 170 mg/day). Significantly more Spata elderly (M 6%, F 17%) were not achieving two thirds of the RDI compared with Melbourne elderly (F 2%, M 0%).

Overall, Greeks in Melbourne (especially women aged 70-79) appeared to have diets of higher vitamin density than Spata elderly, particularly for vitamin A, carotene, thiamin, riboflavin, niacin, and vitamin C. However, the diets of elderly Greeks did not meet the recommended vitamin densities for thiamin (80% of men, 90% women), riboflavin (70% of men, 63% of women), and vitamin A (80% of men, 75% women). Melbourne women aged 70-79, however, achieved the RND for vitamin A and thiamin. Vitamin C and niacin were least likely to be inadequately consumed (especially in Melbourne). Melbourne women had a significantly greater vitamin A and carotene density than the men.